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WAR DEPARTMENT.

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

MAY, 1889.

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UNITED STATES SIGNAL SERVICE MONTHLY WEATHER REVIEW.

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No. 5.

INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for May, 1889, and is based upon reports of regular and voluntary observers of both countries.

On chart i the paths of the centres of eight areas of low pressure are shown; the average number traced for May during the last fifteen years being 8.8. This chart also exhibits the paths of the centres of nine depressions traced over the north Atlantic Ocean; the limits of fog-belts west of the fortieth meridian, and the distribution of icebergs and field ice during the month. The areas of high and low pressure and north Atlantic storms are discussed under their respective headings.

Chart ii exhibits the distribution of mean atmospheric pressure and temperature and the southern and western limits of freezing weather for the month. The mean temperature was below the normal over a greater portion of the interior and southern parts of the country, the departures below the normal being small. In other districts the month was generally warmer than the average May, the greatest departures above the normal being shown in the Canadian Maritime Provinces, where they exceeded 6° . At a number of stations east of the Mississippi River, in Texas, and Washington Territory, the maximum temperature exceeded the highest May temperature recorded during the periods of observation, while at several stations in the Southern States, and from Texas northward to the British Possessions the lowest temperature recorded for May during the periods of observation was noted.

Chart iii shows the distribution of precipitation for May, 1889. The precipitation was generally in excess of the normal over the northern half of the country from the Atlantic

to the Pacific. The most marked excesses in precipitation occurred on the middle Pacific coast, where the rainfall was about 250 per cent. above the normal amount for May, and in the middle Atlantic states, where it was about 50 per cent. in excess of the May average. The greatest deficiencies occurred in the southern plateau region, where but about 6 per cent. of the usual amount of rain for the month fell, and in the Rio Grande Valley, where the rainfall equalled about 20 per cent. of the May average. Marked deficiencies also occurred in the Gulf states and Florida. The exceptionally heavy rains and resultant floods of the last two days of the month in sections of the middle states form the subject of extra charts and tables and are specially discussed in this issue of the REVIEW. A deficiency of rainfall caused serious droughts in sections of the Southern States.

In the preparation of this REVIEW data from 2,535 stations have been used, classified as follows: 176 Signal Service stations; 122 monthly registers from United States Army post surgeons; 1,712 monthly registers from state weather service and voluntary observers; 24 Canadian stations; 169 stations through the Central Pacific Railway Company; 332 marine reports through the co-operation of the Hydrographic Office, United States Navy; marine reports through the "New York Herald Weather Service;" monthly weather reports from the local weather services of Alabama, Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New England, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Texas, and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for May, 1889, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on chart ii by isobars. The difference between the mean pressure for May obtained from observations taken twice daily at the hours named and that determined from hourly observations varies at the stations named below, as follows: At Washington, D. C., Philadelphia, Pa., New York, N. Y., Boston, Mass., Saint Louis, Mo., and Chicago, Ill., the mean of the 8 a. m. and 8 p. m. observations was higher by .009, .008, about .009, .006, .002, and .001, respectively, while at San Francisco, Cal., the mean of the observations taken at these hours was about .016 lower than the true mean pressure.

The mean pressure for May, 1889, was highest along the east Gulf coast and over Florida, where it rose above 30.05, the highest mean reading, 30.07, being reported at Mobile, Ala. Over South Carolina, Georgia, Tennessee, the east Gulf states, Arkansas, Louisiana, eastern and southeastern Texas, and the northern California coast the mean pressure was above 30.00. The mean pressure was lowest over southern

Nevada and the adjoining part of California, where it fell below 29.80, the lowest reading, 29.78, being reported at Keeler, Cal. A trough of low mean pressure, within which the values varied from 29.80 to 29.90, extended from the lower Colorado valley northward over the plateau and Rocky Mountain regions to the Saskatchewan Valley. The mean pressure was below 29.90 in the lower Saint Lawrence valley.

Compared with the pressure chart for April, 1889, an increase in pressure is shown over the Gulf and south Atlantic states, Florida, at stations on the middle Atlantic and southern New England coasts, and over southern Nova Scotia; elsewhere over the country there has been a decrease in pressure. The greatest increase in pressure was noted on the North Carolina coast, where it amounted to .05, and the greatest decrease, about .10, in the British Possessions north of Dakota, and in the lower Missouri valley. In April the mean pressure was highest along the Pacific coast north of the thirty-fifth parallel, while for the current month the highest values were reported on the middle coast of the Gulf of Mexico. The area of lowest mean pressure for the current and the preceding

month occupied the southern plateau region, where the decrease varies from .04 to .07.

Compared with the normal pressure for May the mean pressure was above the normal over the southern plateau region, and from Dakota and eastern Montana southward and southeastward to the Gulf states and Florida; elsewhere the mean pressure was below the normal. The greatest departures above the normal were reported along the middle and west Gulf coast, where they exceeded .05. The most marked departures below the normal were noted on the north Pacific coast and in the valley of the Columbia River, on the Atlantic coast between the thirty-sixth and thirty-ninth parallels, and at stations in the Saint Lawrence Valley, where they were more than .05.

BAROMETRIC RANGES.

The monthly barometric ranges at the several Signal Service stations are given in the table of miscellaneous meteorological data. The general rule, to which the monthly barometric ranges over the United States are found to conform, is that they increase with the latitude and decrease slightly, though somewhat irregularly, with increasing longitude. In May, 1889, the ranges were greatest in Dakota, where they exceeded 1.40, whence they decreased eastward to Lakes Huron and Erie, where they were less than .60, and thence increased to the coast of Maine, where they were more than .80. The ranges decreased southward to southern Florida, where they were .30, and to the south coast of California, where they were less than .20. From Dakota westward the ranges decreased to about .80 in the upper valley of the Columbia River, and thence increased to more than 1.00 on the coast of Washington. Along the Atlantic coast the extreme ranges varied from .30 at Key West, Fla., to .89 at Eastport, Me.; between the eighty-second and ninety-second meridians, .49 at Cedar Keys, Fla., to .76 at La Crosse, Wis.; between the Mississippi River and the Rocky Mountains, .44 at Galveston, Tex., to 1.48 at Huron and Saint Vincent, Dak.; in the plateau and Rocky Mountain regions, .31 at Yuma, Ariz., to 1.00 at Fort McKinney, Wyo.; on the Pacific coast, .19 at San Diego, Cal., to 1.03 at Fort Canby, Wash.

AREAS OF HIGH PRESSURE.

Seven areas of high pressure were observed in or near the limits of the United States during the month of May, three of which were first observed on the Pacific coast, and three approached the stations from the region north of Dakota. These areas moved generally in a southeasterly direction east of the Rocky Mountains, while the movement was to the north of east on the Pacific coast. Four of the areas observed passed over the Atlantic, two disappearing off the south Atlantic coast, while two passed over the north Atlantic. Two of the areas of high pressure which originated on the Pacific coast disappeared by gradual decrease of pressure while central over the Rocky Mountain region.

The following table exhibits in a concise manner some of the more prominent characteristics of the high areas:

No.	First observed.		Last observed.		Duration.	Velocity per hr.	Highest pressure.			
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.		Date.	Station.	Reading.	
I.....	2	54°	103°	32°	82°	5.0	19	1	Qu'Appelle, N. W. T.....	30.58
II.....	8	44	129	37	102	5.0	16	9	Roseburgh, Oregon.....	30.58
III.....	13	53	95	42	57	7.0	21	17	Chatham, N. B.....	30.48
IV.....	15	40	125	30	80	8.5	20	20	Cheyenne, Wyo.....	30.42
V.....	21	43	127	40	99	4.0	25	21	Fort Canby, Wash.....	30.30
VI.....	28	55	97	47	92	3.0	10	30	Duluth, Minn.....	30.38
VII.....	29	43	77	43	57	2.5	16	30	Halifax, N. S.....	30.42
Mean.....						5.0	18.1			30.42

The following is a general description of each area, giving its movement and the more prominent weather conditions observed during its transit over the regions of observations:

I.—On the morning of the 1st this area was central far to the north of Dakota, but it had already extended southward over the eastern slope of the Rocky Mountains to Texas, light frosts having occurred throughout the Northwest and the lake region, the temperature being below freezing in northern Dakota. This area moved directly southward, it being attended by clear weather over the central valleys during the 2d and 3d, causing killing frosts in Nebraska on the 2d and light frosts in the central valleys on the 3d and 4th. After reaching the Indian Territory it passed directly eastward, extending over the entire country east of the Mississippi, causing light frosts in the northern portions of the Gulf states, Tennessee, and North Carolina, and killing frosts in western Virginia, on the 4th. It covered the Atlantic and Gulf states during the 5th and 6th, and finally disappeared after reaching the south Atlantic coast.

II.—This area was central to the west of Oregon on the morning of the 8th, after which it moved slowly to the northeast, approaching the coast, where it remained until the morning of the 10th, a secondary high area forming over the northern Rocky Mountain region during the 9th, after which the pressure decreased on the north Pacific coast, and the secondary area becoming more extended, covering the northern and central Rocky Mountain regions on the 11th, attended by heavy snows and freezing weather in Colorado and Wyoming. It moved directly southward during the 12th, attended by a general decrease of pressure, and disappeared while central over northern Texas on the 13th.

III.—This area of high pressure, although well defined while passing over the northeastern portions of the United States, was at no time central within the limits of the stations of observation. It was observed north of Dakota on the 13th, and passed eastward, reaching the lower Saint Lawrence valley on the 16th, where its course apparently changed to the southward. After extending over the Maritime Provinces, it apparently passed to the southward of Nova Scotia, and was central off the middle Atlantic coast on the 18th, from which region it moved to the northeastward, it being last observed as central to the southeast of Nova Scotia on the 20th.

IV.—This area approached the stations from the Pacific, it being first observed to the west of California on the 15th, where it remained almost stationary during the succeeding forty-eight hours, after which it moved northward, it being central near the mouth of the Columbia River on the afternoon of the 18th. From this position it passed directly southeastward, crossing the Rocky Mountains and extending over the eastern slope on the 21st, forming a ridge of high pressure from Texas northward to Manitoba with two centres, one in Indian Territory and one in Minnesota. The area continued to move eastward after the 21st, the southern area disappearing to the southward over the Gulf, while the northern area moved to the southeastward over the lake region and the central valleys, disappearing off the south Atlantic coast on the 24th. Light frosts occurred in North Carolina, Tennessee, and the Ohio valley on the 23d.

V.—This area also approached the stations from the Pacific. A trough of low pressure extended from Arizona northward over the plateau regions; the preceding area of high pressure covered the eastern Rocky Mountain slope, while area number V extended along the Pacific coast. The area of low barometer which developed within the barometric trough moved to the northeast over British America, and was followed by this area of high pressure which reached the north Pacific coast on the 22d, after which the direction of movement apparently changed to the eastward, the line of greatest pressure being parallel with, and near to, the northern boundary of the United States until the centre reached the one-hundredth meridian. At this point the direction of movement changed to the south, and owing to a decrease of pressure within this area it became less clearly defined, and its movement as a separate area could not be traced after the morning of the 25th, when it extended over the lower Missouri valley.

VI and VII.—Number vi was observed far to the north of Minnesota on the 28th. It moved southward to Lake Superior during the 28th and 29th, where it remained almost stationary until the close of the month, the barometer being above the normal to the eastward, and a secondary area of high pressure (number vii) apparently forming over the lower lake region and the middle Atlantic states. The last-named area of high pressure moved to the northeastward, the pressure increasing during the easterly movement, thereby causing an increased barometric gradient in its west quadrants. The retarded movement of this area, after reaching the coast, was attended by continued southeasterly winds on the middle and south Atlantic coast.

AREAS OF LOW PRESSURE.

Eight areas of low pressure were observed during the month of May, two of which were traced from the north Pacific coast to the east of the Rocky Mountains, four developed in the Rocky Mountain regions, one in the upper Mississippi valley, and one in the upper Ohio valley. The general direction of movement east of the Rocky Mountains was to the northeast, four passing over the Saint Lawrence Valley; two disappeared to the north of the lake region, and one passed off the middle Atlantic coast and thence northeastward to Nova Scotia. The region of greatest frequency of areas of low pressure includes the central and eastern slope of the Rocky Mountains, and, with one exception, all areas of low pressure that passed over the Mississippi Valley reached their lowest latitude near the one-hundredth meridian. The following table exhibits the principal facts regarding these low areas:

No.	First observed.			Last observed.			Duration.	Velocity per hr.	Lowest pressure.		
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.	Station.			Reading.		
I.....	1	45	116	53	96	7.0	8.0	7	Fort Sully, Dak.	25.96	Inches.
II.....	8	37	103	50	64	6.5	18.0	15	Anticosti, Gulf of St. L.	29.60	
III.....	13	47	123	38	98	1.5	24.0	14	Pueblo, Colo.	29.38	
IV a. . . .	15	41	112	51	87	2.5	30.0	15	Pueblo, Colo.	29.52	
IV b. . . .	15	41	112	49	69	7.0	18.0	16	Fort Elliott, Tex.	29.42	
V.....	22	41	81	47	60	2.5	21.0	24	Sydney, C. B. I.	29.50	
VI.....	20	53	118	51	79	2.5	26.0	21	Swift Current, N. W. T.	29.56	
VII.....	26	43	93	52	68	2.5	25.0	27	Saugeen, Ont.	29.42	
VIII.....	28	37	102	48	80	3.5	21.0	28	Fort Elliott, Tex.	29.56	
Means.....				3.9	21.2					29.44	

The following is a general description of the weather conditions attending each low area as determined from the regular telegraphic reports:

I.—This area was central over Oregon on the afternoon of the 1st, the trough of low pressure extending southward to Arizona, while the eastern slope of the Rocky Mountains and the central valleys were covered by an extended area of high pressure. The morning report of the 2d exhibited a slight southeast movement of this low area over the northern plateau region, but the succeeding reports show that the direction of movement changed to northeast, and that it continued this course until the 5th, when the centre was far to the north of Dakota, after which either the principal or secondary disturbance moved southward over the upper Missouri valley, increasing greatly in energy, causing unusually high winds in the northwestern states, which in many localities proved injurious to crops, and in some cases necessitated a replanting. This disturbance remained almost stationary over Dakota during forty-eight hours, the centre reaching its most southerly point at Fort Sully on the morning of the 7th, when the unusually low pressure of 28.96 was observed. This storm moved almost directly north from central Dakota and passed beyond the limits of observation during the night of the 8th without causing any marked disturbance in the regions east of the Mississippi, except the brisk and high winds which were reported in the upper lake region.

II.—This was a feeble disturbance which developed over the

central Rocky Mountain region, and passed slowly southeastward to Texas between the 8th and 11th, attended by heavy local rains in Kansas, Missouri, and Indian Territory. After reaching northern Texas the direction of movement changed to northeast, and it passed over the central Mississippi and the Ohio valleys more as an area of local rains than as a well-marked cyclonic disturbance. The rain area extended during the easterly movement, and the pressure decreased at the centre of disturbance, causing the storm to be well defined as it passed over the Saint Lawrence Valley, and it disappeared northeast of New England on the 15th, the lowest observed pressure attending the storm being 29.60 at Anticosti, Gulf of Saint Lawrence.

III and IV.—An area of low pressure appeared on the north Pacific coast on the 11th, and after advancing to the northeastward during the 11th and 12th, covering the region north of Washington Territory, it passed southward over the northern and central plateau regions, attended by general rains on the Pacific coast as far south as San Francisco. The movement changed to the southeast and it passed over the central Rocky Mountain region during the 14th, dividing into two areas of low pressure, one covering Utah and the other extending over the central and eastern slope of the Rocky Mountains on the morning of the 15th. These areas of low pressure united during the 15th, central over Colorado, and were afterwards traced on the chart as area of low pressure number iv, and referred to in the table as numbers iv a and iv b. The p. m. report of the 15th exhibits a well-defined depression central in Colorado, the pressure at Pueblo being 29.38. The isobars bounding this disturbance were elliptical in general form, the longer axis being in the direction of movement. The weather was generally warm and fair in the southern quadrants, without rain, while colder northeasterly winds and rain prevailed from the Rocky Mountains eastward to the lake region, with occasional snows and freezing weather in the northwest quadrant. The disturbance divided during the night of the 15th, forming two areas—one central in northern Texas and the other in the Missouri Valley. The more northerly disturbance moved rapidly over Lake Superior, disappearing during the night of the 17th, while the depression to the southward remained almost stationary over northern Texas and Indian Territory during the 16th and 17th, after which it passed rapidly to the northeastward, and it was central in the upper Mississippi valley during the night of the 17th, attended by heavy rains in Missouri, Iowa, and southern Wisconsin. Very heavy rains also occurred in Texas and Arkansas, when the winds shifted to northerly after the passage of this storm. After moving northward to southern Minnesota the course of this storm was to the northeastward, passing over Lake Superior on the 18th, after which its course was uncertain, but it has been approximately traced eastward to the Saint Lawrence Valley, it being last located as central near Father Point on the morning of the 22d.

V.—This is a secondary disturbance which developed over Pennsylvania when the storm previously described was passing over the lower Saint Lawrence valley. It moved eastward to the middle Atlantic coast, causing dangerous winds from Hatteras north to Boston on the 23d. These gales were of brief duration, but the wind attained a velocity of fifty-two miles an hour on the North Carolina coast, forty miles on the New Jersey coast, and forty-six miles on the southern New England coast. The depression passed northeastward over Nova Scotia on the 24th with an apparent loss of energy.

VI.—This disturbance was at no time central within the limits of the United States, but it was observed northwest of Montana on the 20th. The succeeding reports show that it passed eastward north of, and nearly parallel to, the northern boundary of the United States. During its easterly movement it was apparently drawn to the southward as it approached the Lake region, where light rains fell during its transit. This storm probably united with number v over, or northeast of, the Maritime Provinces on the 25th.

VII.—This was a secondary disturbance which developed in the southern portion of a more extended low area central north of Minnesota on the 26th. It was first central in Iowa and moved eastward over the lake region, attended by general rains north of the Gulf states. It increased in energy during the easterly movement until it reached the upper Saint Lawrence valley. The minimum pressure, 29.42, occurred at Saugeen on the 27th, when the storm was central near that station. Dangerous westerly winds occurred in the Lake region and heavy rains with southerly gales on the New England and middle Atlantic coasts during the passage of this disturbance. The latter conditions were probably due more to a secondary depression which developed in the south Atlantic states during the 26th.

VIII.—This storm was first observed as central over eastern Colorado and northern Texas on the 28th. An elliptical area of low pressure extended from the Rio Grande northeastward to the lower Missouri valley on the 28th, with an area of high pressure to the northward which apparently forced this disturbance to the eastward over the lower Mississippi valley. On the 29th it covered the greater portion of the Southern States and Ohio Valley, attended by heavy rains from the Lake region southward, which continued during the northeasterly

movement. After reaching the upper Ohio valley the disturbance separated, one centre of low pressure passing towards the coast over Virginia, while the other moved northward over the lower lakes. At the close of the month the southern disturbance was central in southern Virginia, attended by unusually heavy rains in the middle Atlantic states, and these rains continued during the succeeding day and caused destructive floods which form the subject of a special report in this REVIEW. On the back of chart i will be found supplementary charts giving the weather conditions attending the heavy rainfalls during the last days of May and the first of June over the region of destructive floods. It will be observed that the northern centre of disturbance, after reaching the Lake region, apparently divided, and at the close of the month two secondary depressions were indicated by the circulation of winds, one north of Lake Erie and one over southern Michigan. The development of the latter was especially favorable to the agricultural interests of the Northwest, as it caused a continuation of cloudiness, thereby preventing a destructive frost which must have occurred if clearing weather had prevailed on the morning of the 1st in the states north of the Ohio.

NORTH ATLANTIC STORMS FOR MAY, 1889 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the depressions that appeared over the north Atlantic Ocean during May, 1889, are shown on chart i. These paths have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Nine depressions have been traced for May, 1889, the average number traced for the corresponding month of the last four years being ten. Generally fair weather prevailed and storms of unusual strength were not reported save on one date, the 21st, when gales of hurricane force were encountered off the middle Atlantic coast of the United States. Over the western part of the ocean a noteworthy feature was the advance northward from near the West Indies of two depressions. The remaining depressions passed eastward from the American continent, or first appeared over the ocean north of the fortieth parallel. Over mid-ocean strong gales were reported at intervals during the month. In the vicinity of the British Isles severe storms were not noted, although the barometric fluctuations were frequent and marked.

As compared with the corresponding month of previous years the depressions traced for May, 1889, were deficient in number and energy; they pursued normal tracks, and extreme low barometer readings noted in preceding years were not reported attending their passage. The following are brief descriptions of the depressions traced:

1.—This depression was a continuation of number 7 traced for April, 1889, and was central south of Ireland at noon, Greenwich mean time, of May 1st, with pressure falling to about 29.40 (747), and moderate to fresh gales to the twenty-fifth meridian. By the 2d the storm-centre had moved northwest over the British Isles, without evidence of marked strength.

2.—This depression was a continuation of low area xii for April, and on the 1st was central near the northeast coast of Newfoundland, with pressure below 29.60 (752) and fresh gales to the thirty-fifth parallel. Moving east to about longitude W. 39° by the 2d the depression is thence traced northeast to south of Iceland, where it disappeared after the 4th, attended throughout by fresh gales, and a gradual decrease in pressure.

3.—This depression was central over Newfoundland on the morning of the 4th, with pressure falling to about 29.60 (752), and fresh gales over and near the Grand Banks. By the 6th the storm-centre had moved east-northeast over mid-ocean north of the trans-Atlantic steamship routes, attended by fresh

to strong gales, whence it passed east-southeast and disappeared south of the British Isles during the 9th with an apparent decrease in energy after the 6th.

4.—The presence of this depression, about midway between Bermuda and the Bahamas, was indicated by reports of the 5th, to which region it had apparently advanced from the southward. On this date fresh northerly gales were reported north and northeast of the Bahamas. During the next four days the centre of depression moved slowly east of north to the thirty-seventh parallel, attended in the west quadrants by gales of moderate strength. The observer at Bermuda reports that on the 7th thunder-storms were observed all around the horizon from 3 a. m. until morning, and that very light showers prevailed on the island. After the 9th the depression apparently moved north-northeast to east of Nova Scotia, where it was central on the 10th, with pressure below 29.50 (749). From this position the storm-centre passed northeastward over Newfoundland, and thence eastward over the ocean, and disappeared south of the British Isles by the 14th, its passage being attended by a gradual decrease in energy.

5.—This depression appeared northeast of Newfoundland on the 8th and moved eastward to the thirtieth meridian by the 9th, attended by fresh to strong gales, and pressure below 29.40 (747). On the 10th the storm-centre was located west of Ireland, after which it moved eastward and disappeared over the British Isles with an apparent loss of energy.

6.—This depression is given an approximate path north of the West Indies from the 16th to 19th, during which period it possessed moderate energy. On the 19th the storm-centre was central in about N. 30°, W. 75', whence it recurred northward, and on the morning of the 21st was located in about N. 36°, W. 72'. During this date the depression apparently moved northward and united with an area of low pressure which occupied the Saint Lawrence valley. Reports indicate that the disturbances attending this depression were not severe in their character, save on the 21st, when gales of hurricane force were reported. The lowest barometric pressure, about 29.60 (752), was also noted on the 21st.

7.—This depression was a continuation of low area ii which advanced rapidly eastward over northern Newfoundland during the 15th. On the 16th and 17th the depression moved slowly north of east over mid-ocean north of the fiftieth parallel, attended by fresh to strong gales, after which it disappeared north of the region of observation.

8.—This depression was a continuation of low area v, and

by the morning of the 24th the centre of depression had advanced to western Nova Scotia, with pressure about 29.60 (752), and fresh to strong gales to the thirty-fifth parallel. By the 25th the storm-centre had moved rapidly northeastward and disappeared north of Newfoundland.

9.—This was a depression of considerable strength which appeared over mid-ocean in about latitude N. 56° on the 27th, moved eastward to the sixteenth meridian by the 28th, and disappeared north of the British Isles during the 29th, attended throughout by fresh to strong gales and pressure falling below 29.30 (744).

FOG IN MAY.

The following are limits of fog-areas on the north Atlantic Ocean during May, 1889, as reported by shipmasters:

Date.	Entered.		Cleared.		Date.	Entered.		Cleared.	
	Lat. N.	Lon. W.	Lat. N.	Lon. W.		Lat. N.	Lon. W.	Lat. N.	Lon. W.
1	40 20	47 30	14-15	40 59	65 29	40 23	69 05		
3-4	43 50	50 20	43 30	53 40	14-15	46 07	54 34	47 45	60 20
3-4	42 08	50 56	41 40	50 10	16	40 47	64 36	40 42	66 05
3-5	47 00	50 50	46 30	55 50	16-17	41 00	59 00	40 30	64 00
4	45 22	46 13	42 54	50 49	16-18	42 05	60 21		
4-5	43 15	46 50	42 31	50 50	17-18	40 00	65 00	39 15	69 30
4-5	45 00	44 30	43 40	49 30	17-18	40 43	67 16		
6	42 45	54 20	42 40	55 10	19-20	40 00	65 58	39 47	68 07
6-7	43 09	59 30	42 50	63 00	19-20	40 57	67 18	40 40	71 40
7	41 19	60 05	41 18	61 15	21	38 31	74 30	38 43	74 22
7-8	43 13	64 28	40 30	73 02	20-21	42 42	65 10	42 31	68 20
7-8	42 35	66 05	42 24	70 20	21	40 52	66 50	40 48	67 33
7-8	41 20	63 00	Off Sandy Hook.		21-22	42 35	60 23	40 55	67 59
8	42 49	49 30	42 44	52 15	21-22	41 32	65 48	41 00	69 00
8-9	41 30	64 11	40 23	69 16	22	42 50	64 00	42 30	68 00
9	47 25	59 00	47 09	58 13	22	44 26	55 00	42 44	59 55
9-10	40 27	72 04	40 47	63 00	22	41 38	63 55	40 57	66 45
9-10	40 30	65 30	40 00	67 30	22-23	45 37	44 05	43 25	50 18
10	40 44	65 30	40 45	68 35	22-23	41 50	63 15	41 00	68 05
10	42 43	55 24	42 38	58 40	23	44 11	44 28	43 47	45 25
10-11	43 24	48 57	42 13	56 09	25	42 50	49 27	42 32	50 15
11	42 50	47 30	41 36	50 25	25-26	46 48	52 24	46 18	52 51
11	44 08	47 27	43 10	50 18	26	41 10	64 00	41 00	65 30
11	44 14	45 47	43 51	47 35	26-27	43 43	47 09	42 43	50 42
11-12	42 09	49 45	43 11	47 29	27	41 23	66 12	41 13	66 45
12	43 40	48 30	43 35	50 20	27-28	44 02	48 39	42 54	55 12
13	41 00	65 40	Sandy Hook.		27-28	43 50	46 50	42 40	53 50
13	40 27	71 49	40 24	73 50	28	46 58	52 47	46 32	53 24
13-14	36 44	74 00	38 48	74 00	28	38 58	72 54	38 53	74 02
13-14	40 12	67 22	42 18	70 25	28	40 44	68 22	40 36	69 47
13-14	40 18	68 32	38 44	74 21	28	42 24	65 15	42 21	58 24
14	40 58	66 55	40 32	71 27	29	41 04	67 00	41 02	67 16
14	42 55	64 21	42 15	68 38	30	41 11	65 32	40 55	67 32
14-15	40 18	72 24	40 14	69 15	30-31	42 47	65 16	41 25	66 46

On chart i the limits of fog-belts west of the fortieth meridian are shown by dotted shading. Over and near the Banks of Newfoundland fog was reported on fifteen dates, as compared with nineteen dates for April, 1889, and seventeen dates for May, 1888. Between the fifty-fifth and sixty-fifth meridians fog was reported on fifteen dates, as compared with eighteen dates for April, 1889, and nine dates for May, 1888. West of the sixty-fifth meridian fog was reported on twenty dates, as compared with sixteen dates for April, 1889, and twenty-two dates for May, 1888. In the vicinity of the Grand Banks the development of fog attended the approach or passage of areas of low pressure, except on the 2d, when a depression was central near Bermuda, and on the 27th and 28th, when high pressure and variable winds prevailed. To the south and southeast of Nova Scotia fog was reported with the advance or passage to the northward of areas of low pressure, save from the 6th to 9th, inclusive, when a depression was advancing northward from near Bermuda, on the 16th, 17th, and 28th, when high barometer and variable winds, mostly southerly, prevailed, and on the 21st and 22d, with the advance northward of a depression off the middle Atlantic and New England coasts. West of the sixty-fifth meridian fog was reported on five dates with depressions central over the Gulf of Saint Lawrence or the lower Saint Lawrence valley; from the 7th to 9th, attending the northward passage of a depression from near Bermuda; from the 16th to 19th, with high barometer and variable winds, mostly from south to east; from the 20th to 22d, with the northward advance of a depression off the middle Atlantic and New England coasts, and from

the 27th to 31st with a gradual increase in pressure and variable and southerly winds.

Reports of the preceding two years indicate that May is the month of greatest fog frequency along and off the American coast west of the sixty-fifth meridian, and that the periods of greatest fog-prevalence south of Nova Scotia and over and near the Grand Banks occur during the summer months.

OCEAN ICE IN MAY.

The following table shows the southern and eastern limits of the region within which icebergs or field ice were reported for May during the last seven years:

Month.	Southern limit.		Month.	Eastern limit.	
	Lat. N.	Long. W.		Lat. N.	Long. W.
May, 1883.....	40 30	47 00	May, 1883.....	45 40	45 12
May, 1884.....	41 30	47 30	May, 1884.....	43 30	44 50
May, 1885.....	40 50	48 15	May, 1885.....	42 30	40 10
May, 1886.....	41 35	51 30	May, 1886.....	45 55	46 13
May, 1887.....	39 38	46 00	May, 1887.....	39 35	46 00
May, 1888.....	41 00	46 00	May, 1888.....	41 00	46 00
May, 1889.....	43 07	55 47	May, 1889.....	49 46	36 48

The above table shows that for May, 1889, ice was reported about two degrees north and about eight degrees east of the average southern and eastern limits of ice for the month, as determined from reports of the preceding six years. In the current month icebergs were most frequently encountered off the northeast edge of the banks of Newfoundland; they were reported south of the forty-fifth parallel on two dates only, and east of the fortieth meridian on but one date. No icebergs or field ice were reported near the east or south coasts of Newfoundland save on the 2d, when a large berg was observed near Cape Spear, and icebergs were reported on but three dates west of the fiftieth meridian. As compared with the ice record for the preceding month there has been a large increase in the aggregate quantity of ice reported, while a comparison of the current month with the corresponding month of previous years shows that about the average quantity of ice for May was reported and that the ice region is contracted to the northward and extends to the eastward of the average limits of ice for the month.

The following positions of icebergs and field ice reported during the month are shown on chart i by ruled shading:

1st.—N. 46° 00', W. 46° 00', an iceberg.

2d.—East-northeast from Cape Spear, N. F., a very large berg.

3d.—N. 48° 15', W. 46° 51', two bergs; N. 47° 15', W. 47° 00', a long flat berg about fifty feet high and three hundred feet long; N. 47° 47', W. 46° 20', two medium-sized bergs, one conical and one flat; N. 43° 07', W. 55° 47', some field ice about twelve miles distant; N. 49° 47', W. 45° 06', a medium-sized berg; from N. 49° 13', W. 47° 10' to N. 48° 50', W. 48° 15', eight bergs; N. 50° 03', W. 44° 40', a large berg.

4th.—N. 49° 10', W. 46° 45', several bergs; from N. 48° 36', W. 48° 46' to N. 48° 24', W. 49° 15', four bergs; N. 49° 02', W. 47° 20', a number of large bergs for eighty-five miles on a S. 60° W. true course from the position given.

7th.—N. 46° 49', W. 46° 00', a large berg with lofty summit; N. 46° 50', W. 46° 30', a large round berg; N. 46° 56', W. 46° 35', a large round berg; N. 48° 47', W. 45° 36', a number of bergs and a quantity of field ice; last berg in N. 48° 34', W. 46° 15'.

8th.—N. 47° 57', W. 48° 54', the last berg of a number passed during the night on a south of west course.

9th.—N. 46° 26', W. 44° 22', a very large berg; N. 46° 51', W. 45° 22', a large berg one and one-half miles to southward; N. 49° 46', W. 36° 48', a small berg.

10th.—N. 48° 09', W. 44° 24', a piece of ice apparently broken from a large berg; N. 48° 07', W. 44° 28', a large berg; N. 48° 03', W. 44° 36', a medium-sized berg; N. 47° 33', W. 45° 41', a large berg; N. 48° 30', W. 46° 10', several small bergs and a quantity of field ice; N. 48° 04', W. 49° 48', a

medium-sized berg; N. $49^{\circ} 19'$, W. $49^{\circ} 09'$, one large and two small bergs; N. $48^{\circ} 00'$, W. $46^{\circ} 00'$ to N. $47^{\circ} 37'$, W. $46^{\circ} 30'$, several large bergs and a large quantity of small detached pieces, very dangerous.

12th.—N. $47^{\circ} 40'$, W. $44^{\circ} 05'$ a large berg; N. $47^{\circ} 26'$, W. $45^{\circ} 00'$, three large bergs three miles apart east and west; N. $47^{\circ} 14'$, W. $46^{\circ} 00'$, a very large berg with flat top and perpendicular sides.

13th.—N. $48^{\circ} 03'$, W. $49^{\circ} 48'$, a small berg; N. $48^{\circ} 16'$, W. $49^{\circ} 19'$, three small bergs.

13-14th.—N. $46^{\circ} 55'$, W. $47^{\circ} 10'$ to N. $48^{\circ} 08'$, W. $44^{\circ} 01'$, six bergs and many pieces of ice.

14th.—N. $46^{\circ} 54'$, W. $45^{\circ} 00'$, large bergs about eighty feet high.

15th.—N. $48^{\circ} 10'$, W. $49^{\circ} 03'$, a very large berg; N. $48^{\circ} 00'$, W. $49^{\circ} 48'$, a very large berg and several small pieces to leeward.

16th.—N. $47^{\circ} 35'$, W. $42^{\circ} 35'$, a berg fifty feet high and three hundred feet long.

17th.—N. $46^{\circ} 25'$, W. $42^{\circ} 53'$, a berg seventy feet high and three hundred and fifty feet long; N. $46^{\circ} 54'$, W. $42^{\circ} 00'$, a berg about forty feet high and one hundred and fifty feet long one mile distant; N. $48^{\circ} 10'$, W. $49^{\circ} 10'$, several large bergs.

18th.—N. $48^{\circ} 30'$, W. $50^{\circ} 40'$, ten or twelve bergs; N. 48°

32', W. $48^{\circ} 43'$, 10 a. m., passed several small bergs, and continued passing them until 4 p. m., when they set in thick, some being over one hundred feet high and four hundred feet long.

19th.—N. $47^{\circ} 27'$, W. $48^{\circ} 20'$, five large bergs from 9 a. m. till noon; N. $48^{\circ} 10'$, W. $47^{\circ} 05'$, two large bergs.

21st.—N. $46^{\circ} 53'$, W. $46^{\circ} 05'$ to N. $46^{\circ} 40'$, W. $47^{\circ} 10'$, twelve bergs, some large ones.

22d.—N. $46^{\circ} 23'$, W. $42^{\circ} 19'$, one long low-lying berg, with detached pieces, and a large piece of ice one mile to southward; N. $48^{\circ} 18'$, W. $49^{\circ} 08'$, one large and two small bergs; N. $48^{\circ} 06'$, W. $48^{\circ} 59'$, one large berg and several small pieces.

24th.—N. $45^{\circ} 14'$, W. $40^{\circ} 43'$, a small berg; N. $47^{\circ} 53'$, W. $48^{\circ} 00'$, one medium-sized berg.

26th.—N. $46^{\circ} 45'$, W. $43^{\circ} 05'$, a berg about one hundred and fifty feet high.

30th.—N. $45^{\circ} 40'$, W. $45^{\circ} 16'$, a medium-sized berg with one high peak.

30-31st.—N. $48^{\circ} 51'$, W. $47^{\circ} 07'$ to N. $48^{\circ} 03'$, W. $50^{\circ} 21'$, numerous large bergs.

31st.—N. $44^{\circ} 35'$, W. $48^{\circ} 30'$, three bergs within two to three miles; N. $47^{\circ} 43'$, W. $44^{\circ} 18'$, three bergs; N. $45^{\circ} 34'$, W. $47^{\circ} 30'$ to N. $45^{\circ} 22'$, W. $48^{\circ} 00'$, six small bergs; N. $48^{\circ} 50'$, W. $47^{\circ} 26'$ to N. $48^{\circ} 15'$ W. $49^{\circ} 01'$, several bergs, large and small.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for May, 1889, is exhibited on chart ii by dotted isotherms. In the table of miscellaneous meteorological data the monthly mean temperature and the departure from the normal are given for regular stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above.

For May, 1889, the mean temperature was highest in the middle and lower Colorado and the lower Gila valleys, where, at stations, the values rose above 80° , the highest mean reading, $84^{\circ} 2$, being reported at Mammoth Tank, Cal. Over southern and west-central Florida, the lower Rio Grande valley, the extreme southwestern part of New Mexico, southern Arizona, adjoining parts of California, southern Nevada, and Arizona, and within a limited area in east-central California, the mean temperature was above 75° . The mean readings were above 70° south of a line traced from Wilmington, N. C., irregularly westward to southern New Mexico, over southwestern Arizona, the western half of California south of the thirty-eighth parallel, and within limited areas in northwestern Nevada, central Kansas, and adjoining parts of west-central Tennessee and Arkansas. The lowest mean temperature for the month was noted at stations in central Colorado, where it fell below 40° . The mean values were below 50° in the lower Saint Lawrence valley, over Lake Superior and northern Lake Huron, and in the Canadian Northwest Territories.

The mean temperature was above the normal in New England, at a majority of stations in the eastern portions of the middle Atlantic and south Atlantic states, and within an area extending from the north Pacific coast and Columbia valley southeastward to Arizona, New Mexico, and northern Texas; in all other districts the temperature was generally below the normal. The greatest departures above the normal were noted in New Brunswick and Nova Scotia, where they exceeded 6° . The departures below the normal were small and nowhere amounted to 5° .

The following are some of the most marked departures from the normal at the older established Signal Service stations:

	Above normal.	Below normal.	
Chatham, N. B.....	8.0	Fort Buford, Dak.....	4.8
Boston, Mass.....	4.3	Mobile, Ala.....	4.5
Spokane Falls, Wash.....	3.0	Abilene, Tex.....	4.5
Fort Apache, Ariz.....	2.8	San Francisco, Cal.....	4.2
Kitty Hawk, N. C.....	2.5	Louisville, Ky.....	3.9

DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperature for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for May, 1889; (4) the departure of the current month from the normal; (5) and the extreme monthly means for May during the period of observation and the years of occurrence:

State and station.	County.	(1) Normal for the month of May.	(2) Length of record.	(3) Mean for May, 1889.	(4) Departure from normal.	(5) Extreme monthly mean temperature for May.			
						Highest.	Year.	Lowest.	Year.
Arkansas.									
Lead Hill.....	Boone.....	68.0	7	67.9	-0.1	74.4	1886	62.9	1882
California.									
Sacramento.....	Sacramento.....	64.3	36	61.4	-2.9	70.2	1865	58.5	1860
Colorado.									
Fort Lyon.....	Bent.....	63.4	20	60.1	-3.3	68.8	1879	58.9	1873
Connecticut.									
Middletown.....	Middlesex.....	57.0	22	60.0	+3.0	61.3	1864	52.4	1861
Florida.									
Merritt's Island.....	Brevard.....	75.2	5	73.9	-1.3	79.2	1884	70.3	1886
Georgia.									
Forsyth.....	Monroe.....	72.8	15	73.5	+0.7	75.8	1880	69.2	1877
Illinois.									
Peoria.....	Peoria.....	64.7	33	62.6	-2.1	71.4	1881	55.2	1867
Riley.....	McHenry.....	57.3	33	55.6	-1.7	64.4	1881	49.8	1867
Indiana.									
Java.....	Switzerland.....	65.1	22	64.2	-0.9	71.2	1880	60.4	1887
Iowa.									
Cresco.....	Howard.....	56.6	17	56.0	-0.6	61.1	1881	49.9	1888
Monticello.....	Jones.....	59.5	35	59.9	+0.4	66.1	1881	51.8	1867
Logan.....	Harrison.....	62.2	15	62.7	+0.5	71.3	1880	56.1	1875
Kansas.									
Lawrence.....	Douglas.....	65.1	27	64.2	-0.9	70.6	1880	55.5	1887
Wellington.....	Sumner.....	63.0	10	66.4	+1.4	71.1	1880	58.2	1882
Louisiana.									
Grand Coteau.....	Saint Landry.....	74.9	6	73.2	-1.7	75.7	1884	73.2	1889
Maine.									
Gardiner.....	Kennebec.....	53.3	49	56.7	+3.4	57.0	1880	49.1	1886
Maryland.									
Cumberland.....	Allegany.....	59.8	26	62.9	+3.1	67.0	1880	51.1	1886

Deviations from normal temperatures—Continued.

State and station.	County.	(1) Normal for the month of May.	(2) Length of record.	(3) Mean for May, 1889.	(4) Deviation from normal.	(5) Extreme monthly mean temperature for May.			
						Highest.	Year.	Lowest.	Year.
Massachusetts.		o	Years	o	o				
Amherst	Hampshire	57.0	53	60.8	+3.8	64.2	1880	52.7	1842
Newburyport	Essex	55.2	10	58.9	+3.7	61.0	1880	50.2	1882
Somerset	Bristol	55.1	16	62.0	+3.9	63.6	1880	51.7	1882
Michigan.									
Kalamazoo	Kalamazoo	57.7	12	56.5	-1.2	66.0	1881	41.3	1882
Thornville	Lapeer	57.8	12	57.7	-0.1	66.6	1880	46.9	1877
Minnesota.									
Minneapolis	Hennepin	57.4	24	56.0	-1.4	63.4	1887	47.9	1867
Montana.									
Fort Shaw	Lewis & Clarke	54.3	20	52.8	-1.5	59.8	1880	47.4	1883
New Hampshire.									
Hanover	Grafton	54.3	54	59.2	+4.9	62.0	1880	48.7	1850
New Jersey.									
Moorestown	Burlington	60.5	26	62.1	+1.6	68.0	1880	54.4	1882
South Orange	Essex	60.6	17	60.7	+0.1	66.4	1880	57.3	1885
New York.									
Cooperstown	Otsego	54.5	35	57.0	+2.5	60.7	1880, '87	46.7	1861
Palermo	Oswego	54.8	35	57.2	+2.4	60.9	1880	47.5	1867
North Carolina.									
Lenoir	Caldwell	62.4	16	63.9	+1.5	67.8	1887	48.0	1881
Ohio.									
North Lewisburgh	Champaign	61.4	57	63.0	+1.6	68.0	1887	53.0	1838
Wauseon	Fulton	58.8	19	58.4	-0.4	64.3	1880	52.2	1882
Oregon.									
Albany	Linn	52.8	12	58.6	+5.8	60.3	1885	52.4	1880
Eola	Polk	53.8	19	57.9	+4.1	59.1	1888	45.2	1880
Pennsylvania.									
Dyberry	Wayne	54.3	22	56.3	+2.0	64.1	1880	43.7	1865
Grampian Hills.	Clearfield	56.4	24	59.6	+3.2	65.1	1887	48.8	1867
Wellsborough	Tioga	56.5	10	55.3	-1.2	68.4	1879	50.5	1882
South Carolina.									
Statesburgh	Sumter	70.1	8	71.9	+1.8	73.8	1881	65.9	1885
Tennessee.									
Austin	Wilson	69.4	20	66.6	-2.8	79.2	1887	64.5	1877
Milan	Gibson	67.1	6	66.3	-0.8	71.4	1887	64.0	1883
Texas.									
Fort Concho	Tom Green	74.8	14	74.6	-0.2	81.1	1886	68.7	1884
New Ulm	Austin	74.4	16	73.1	-1.3	77.4	1879	72.0	1885
Vermont.									
Stratford	Orange	56.1	16	60.8	+4.7	63.0	1887	50.5	1882
Virginia.									
Bird's Nest	Northampton	65.2	21	66.1	+0.9	73.7	1880	60.8	1869
Wisconsin.									
Madison	Dane	56.8	20	55.4	-1.4	64.2	1870	51.5	1883
Washington.									
Fort Townsend	Jefferson	53.8	17	57.0	+3.2	57.0	1889	50.2	1880

The above table shows that at one station, Fort Townsend, Wash., with a broken record of seventeen years, the mean temperature for the month was $0^{\circ}.2$ above the highest previous mean for the month, recorded in 1885, and that one station, Grand Coteau, La., with a record of six years, reports a mean temperature, $0^{\circ}.7$, below the lowest previous mean for May, noted in 1885. At Fort Townsend the mean for the current month was 17° above the lowest May mean, recorded in 1880, and at Grand Coteau the mean was $2^{\circ}.5$ below the highest mean for May, noted in 1884. At Gardiner, Me., with a record of forty-nine years, the mean was but $0^{\circ}.3$ below the maximum mean temperature for the month, recorded in 1880. Among stations showing marked differences (10° or more) between the current mean and the lowest mean temperature noted for May are: Kalamazoo, Mich., twelve years record, 10° below mean of 1881; Wellsborough, Pa., ten years broken record, 13° below mean of 1879. Among stations showing marked differences (10° or more) between the current mean and the lowest mean temperature noted for May are: Cumberland, Md., twenty-six years record, 12° above mean of 1866; Somerset, Mass., sixteen years record, 10° above mean of 1882; Kalamazoo, Mich., twelve years record, 15° above mean of 1882; Thornville, Mich., twelve years broken record, 11° above mean of 1877; Hanover, N. H., fifty-four years record, 10° above mean of 1850; Cooperstown and Palermo, N. Y., thirty-five years record each, 10° above mean of 1861 and 1867, respectively; Lenoir, N. C., sixteen years record, 16° above mean of 1881; North Lewisburgh, Ohio, fifty-seven years record, 10° above mean of 1838; Eola, Oregon, nineteen years record, 13° above mean of 1880; Dyberry, Pa., twenty-two years broken record, 12° above mean of 1865; Grampian Hills, Pa., twenty-four years record, 11° above mean of 1867; Stratford, Vt., sixteen years record, 10° above mean of 1882.

MAXIMUM AND MINIMUM TEMPERATURES.

Maximum temperatures above 100° were reported in the valleys of the Gila and Colorado rivers in Arizona and Nevada, and in the Sacramento and San Joaquin valleys in California, the highest reading, 108° , being noted at Fort Mojave, Ariz. The temperature rose above 90° east of the Mississippi and south of the Ohio valleys, except along the east Gulf and New England coasts, at stations in the interior of Texas, the middle Missouri valley, the middle and southeastern slopes of the Rocky Mountains, portions of the plateau regions southward from the valley of the Columbia River, and north-central and southern California. The lowest maximum temperatures were noted along the south Rhode Island, southeast Massachusetts, and east Maine coasts, where they fell to or below 70° , the lowest reading, 69° , being reported at Nantucket, Mass. At a number of stations east of the Mississippi River, at one station in Texas, and at one station in Washington Territory the maximum temperature equalled or exceeded the highest temperature recorded during the periods of observation. At New Haven, Conn., with a record of seventeen years, the maximum temperature for May, 1889, was 2° above the highest previous reading for the month, which occurred in 1880; at Albany, N. Y., sixteen years record, the same as maximum of 1880; Atlantic City, N. J., sixteen years record, the same as maximum of two or more previous years; Cape Henry, Va., sixteen years record, 4° above maximum of 1875; Charlotte, N. C., eleven years record, 1° above maximum of 1881; Kitty Hawk, N. C., fifteen years record, 1° above maximum of 1880; Wilmington, N. C., nineteen years record, 2° above maximum of 1878; Charleston, S. C., seventeen years record, 2° above maximum of 1878; Indianapolis, Ind., sixteen years record, 1° above maximum of two or more previous years; Buffalo, N. Y., seventeen years record, 2° above maximum of 1876; Rochester, N. Y., eighteen years record, 2° above maximum of 1879; Alpena, Mich., seventeen years record, the same as maximum of 1874; Springfield, Ill., ten years record, the same as maximum of 1881; Fort Elliott, Tex., ten years record, 2° above maximum of 1886; Olympia, Wash., twelve years record, the same as maximum of 1887. At stations in the upper Mississippi, Missouri, and Rio Grande valleys, the middle and west Gulf states, on the eastern slope of the Rocky Mountains, and along the north and south Pacific coasts the maximum temperature was below the maximum reported for the corresponding month of previous years by values exceeding 10° , and amounting to 19° at Fort Buford, Dak. The maximum temperature for May, in preceding years, was generally noted in New England and the middle Atlantic states in 1880; in the south Atlantic states in 1878; in Tennessee and the lower Lake region in 1879; in the upper Mississippi valley in 1874; in northern Texas, Arkansas, Indian Ter., and Montana in 1886; in the middle and north plateau regions, and the middle and north Pacific coasts in 1887; in all other districts the periods of occurrence were irregular.

The lowest temperatures for the month were reported in east-central Dakota and the adjoining part of Minnesota, where they fell to or below 20° . The values were below 30° over Lake Huron, eastern and northern Lake Superior, the upper Missouri valley, over portions of the northeastern and middle-eastern slope of the Rocky Mountains, and within an elongated area extending from south-central Oregon to northwestern Arizona. The highest minimum temperature, 66° , was reported at Key West, Fla., while at Hatteras, N. C., at stations on the Georgia, Florida, and west Gulf coasts, and at Yuma, Ariz., and San Diego, Cal., the minimum readings were above 50° . At a number of stations in the Southern States, and from Texas northward to Minnesota and Dakota the lowest temperature recorded during the periods of observation was noted. At Charlotte, N. C., eleven years record, the minimum temperature for May, 1889, was 2° below the lowest previous reading for the month, which occurred in 1888; Pensacola, Fla., ten years record, the same as minimum of 1883; Mobile, Ala., nineteen years record, 1° below minimum of

1883; Montgomery, Ala., seventeen years record, the same as minimum of 1883; New Orleans, La., nineteen years record, 2° below minimum of 1871 and 1877; Fort Smith, Ark., seven years record, 2° below minimum of 1885; Little Rock, Ark., ten years record, the same as minimum of 1883; San Antonio, Tex., twelve years record, 1° below minimum of 1887; Knoxville, Tenn., nineteen years record, the same as minimum of 1888; Moorhead, Minn., nine years record, the same as minimum of 1883; Huron, Dak., eight years record, 2° below minimum of 1888; North Platte, Nebr., fifteen years record, 3° below minimum of 1885; Fort Elliott, Tex., ten years record, the same as minimum of 1885; Fort Sill, Ind. T., twelve years record, 4° below minimum of 1887. The minimum temperature reported for May in preceding years was generally noted in western Pennsylvania, Virginia, and along the coasts of North Carolina and South Carolina in 1876; on the Georgia and east and south Florida coasts and Rio Grande valley in 1877; in the east Gulf states in 1883; in the upper Mississippi and Missouri valleys, and over Lake Michigan in 1875; on the northeastern slope of the Rocky Mountains in 1885; over the middle plateau region in 1887; on the south Pacific coast in 1883; in all other districts the minimum temperatures were noted for different years at the several stations. The minimum temperatures were less than 10° above the absolute minimum temperatures for May for preceding years, except in western Pennsylvania, at stations in the upper Mississippi and Missouri valleys, and in western Oregon, where the readings were 10° to 11° above the lowest previous values.

RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature at regular stations of the Signal Service are given in the table of miscellaneous meteorological data. The greatest monthly ranges occurred in the middle Missouri and upper Red River of the North valleys, along parts of the Lake Ontario and Lake Huron coasts, in adjoining portions of northern Texas and Indian Territory, and within an area extending from New Mexico and Arizona to southern Oregon, where they exceeded 60°, and at one station, Ashland, Oregon, 70°. The ranges generally decreased from the interior of the country to the Atlantic, Pacific, and Gulf coasts, where, at a number of stations, they were less than 30°.

The following are some of the extreme monthly ranges:

Greatest.	Least.
Ashland, Oregon.....	72.0
Huron, Dak.....	68.0
Fort Supply, Ind. T.....	66.0
Alpena, Mich.....	65.0
Lava, N. Mex.....	64.0
Rochester, N. Y.....	61.0
Key West, Fla.....	20.0
Eureka, Cal.....	25.0
Port Eads, La.....	25.0
Brownsville, Tex.....	25.0
Nantucket, Mass.....	29.0
Jupiter, Fla.....	33.0

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for May, 1889:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
Boston, Mass.....	°	°	°	°	°
Canby, Fort, Wash.....	62.0	47.8	14.2	54.9	60.3
Cedar Keys, Fla.....	64.0	55.5	8.5	58.8	55.1
Charleston, S. C.....	86.8	68.9	17.9	80.3	73.0
Eastport, Me.....	77.8	67.7	10.1	73.7	73.6
Galveston, Tex.....	43.8	40.0	3.8	41.7	49.4
Key West, Fla.....	81.0	72.0	9.0	76.0	73.7
Nantucket, Mass.....	86.4	75.0	11.4	81.9	77.8
New York City.....	66.0	52.0	14.0	59.6	54.2
Pensacola, Fla.....	62.5	49.6	12.9	57.2	62.0
Portland, Oregon.....	77.3	70.3	7.0	73.7	71.4
	67.5	55.0	12.5	59.4	60.3

FROST.

Frost was reported in all of the Southern States, except

Florida and Louisiana, but was not noted as far south as during the preceding month. It was not reported along or near the middle and south Atlantic and Gulf coasts, nor on the Pacific coast, except at stations in north-central and south-central Oregon. Frost injured crops and tender vegetation in some of the more Northern States and territories east of the Pacific coast, and in Arkansas, North Carolina, and Tennessee it damaged cotton plants. The following reports of frost, injurious to vegetation, have been made:

Fayette, Fayette Co., Iowa: frost on the 1st, 2d, 3d, 21st, and 22d caused damage to corn, potatoes, and garden vegetables; fruit also suffered slightly.—*Report of voluntary observer*.

Fort Sully, Dak., 2d: the minimum temperature this morning was 25°. The prevailing cold weather has done much damage to early garden crops.

Chicago, Ill., 3d: dispatches from Decatur, Galesburgh, Monticello, and Tuscola, Ill., and from Wabash, Crawfordsville, and Covington, Ind., report heavy frost the last two nights. In many places small fruit was reported killed, and many vegetables and potatoes were frozen. In some places snow fell, and at Crawfordsville ice formed a quarter of an inch thick.—*New York Daily Tribune, May 4*.

Dale Enterprise, Rockingham Co., Va.: a damaging frost occurred the night of the 3d-4th, killing tender vegetation, and the corn, which has just appeared above ground, is injured.—*Report of voluntary observer*.

Little Rock, Ark.: the frost which occurred on the bottom lands the morning of the 4th was very destructive to young corn and cotton.

Bluefield, Mercer Co., W. Va., 4th: after five days of almost incessant rain and gradually lowering temperature this section was visited last night by a heavy frost. Ice formed on the ponds in many places. Farmers from this and McDowell counties, and of Tazewell, Russell, and Bland counties, Virginia, are unanimous in their fear that the fruit is totally destroyed.—*Baltimore American, May 5*.

Lincoln, Keweenaw Co., Wis.: a severe frost occurred on the 4th and 5th; ice one-eighth inch thick formed, killing early potatoes and corn.—*Report of voluntary observer*.

Lexington, Rockbridge Co., Va., 4th: a very heavy frost occurred; ice formed in places and the ground froze. The damage to truck gardens and early vegetation is heavy, most of the crops being killed.—*The (Lynchburg, Va.) Advance, May 4*.

Lynchburgh, Va., 4th: a heavy frost in the morning covered this section, doing, it is feared, serious damage to fruit and vegetables. In the mountain ranges for nearly two hundred miles it was very heavy.—*Baltimore American, May 5*.

Reading, Pa., 4th: for the last three nights considerable damage has been done in this section to early vegetation by hard frost.—*Duluth (Minn.) Daily News, May 5*.

Kalamazoo, Kalamazoo Co., Mich.: a disastrous frost visited southwestern Michigan during the 20th-21st. Reports from all sections show great damage to early vegetables and small fruit, and in some localities wheat and corn suffered severely.—*Rochester, N. Y., Union and Advertiser, May 29*.

Milwaukee, Wis.: reports from Hudson, La Crosse, Chippewa Falls, Necedah, Columbus, and Rosedale, Wis., show that frost on the morning of the 22d was destructive in those sections. Corn and potatoes were frozen in the ground, and tender garden vegetables were severely damaged. The condition of corn in some places will necessitate replanting. Grapes and small fruit also sustained injury.—*The (Milwaukee) Evening Wisconsin, May 22*.

Port Huron, Mich.: reports show that frost on the 23d was very destructive in this section, especially to all kinds of fruit. Clover, corn, and oats were also badly injured, and in some places the foliage on trees was entirely killed. A somewhat strange fact in connection with the frost is that a few miles inland, upon soil of a dark color, the effect was much more serious than upon soil of a light color, the line of demarcation being plainly seen. This statement was made by J. W. Thompson, sr., who owns a farm some miles from this place.

Charlotte, N. C., 23d: frost is reported from the surrounding country. Some cotton is reported killed by it.

Columbus, Bartholomew Co., Ind., 24th: a heavy frost occurred here last night, which did considerable damage to fruit and vegetables. The wheat, which is heading out, is somewhat injured.—*Oswego, N. Y., Daily Times*, May 24.

Wabash, Ind.: great damage was done to the corn and potato crops in this vicinity by the freeze during the night of the 22-23d. The corn plants are brown and withered, and the crop will be cut short, if replanting to a large extent may not be required. The weather is the coldest ever known at this season.—*Rochester, N. Y., Democrat and Chronicle*, May 25.

Marquette, Mich., 25th: heavy frost occurred during the night, causing some damage to vegetation.

Dover, Strafford Co., N. H., 27th: there was a heavy frost in this vicinity yesterday morning, doing great damage to crops.—*Rochester, N. Y., Union and Advertiser*, May 27.

Detroit, Mich.: reports from Holland, Pontiac, Cadillac, Battle Creek, and Galesburgh, Mich., state that a very damaging frost occurred on the morning of the 28th. Corn, fruit, and garden vegetables were killed, and potatoes, clover, wheat, and rye seriously injured. Much of the corn will have to be replanted. Ice formed in places one-half inch thick.—*Detroit Tribune*, May 29.

Milwaukee, Wis., 28th: reports from Plymouth, Oshkosh, Ellsworth, Delavan, Fort Atkinson, and Palmyra, Wis., show that the frost which occurred during the morning was very destructive to small fruit, corn, garden vegetables, etc. The frost-bitten section is quite wide-spread.—*The (Milwaukee) Evening Wisconsin*, May 28.

Alpena, Mich.: frost on the mornings of the 28th and 29th did considerable damage to vegetation, trees, and garden truck.

Jamestown, Chautauqua Co., N. Y., 29th: frost did immense damage in western New York and northern Pennsylvania last night. Reports show that the damage to grass, wheat, potatoes, flowers, and vegetables is inestimable. Farmers have already commenced replanting such crops as will have time to mature.—*Cleveland Reader and Herald*, May 30.

Rochester, N. Y., 29th: reports from Medina, Chili Station, Warsaw, North Cohocton, Mount Morris, Buffalo, and Albany, N. Y., state that the frost of last night caused much damage to early crops at those places. Fruit also suffered severely.—*Rochester, N. Y., Post Express*, May 29.

Erie, Pa.: the frost on the morning of the 29th injured vegetation seriously.

Memphis, Tenn.: the frost which occurred on the morning of the 31st was general throughout this section, and will prove disastrous to young cotton in the lowlands.

Saint Paul, Minn.: reports show that the frost during the last four days of the month was general and very destructive throughout the state. All tender plants were ruined; corn was badly hurt, and, in some places, even oats and wheat showed the effects of it.

Milwaukee, Wis., 31st: frosts and cold weather during the month have caused slight damage in this vicinity to strawberries, vegetables, etc. In the interior and northern portions of the state the damage was considerable, and will necessitate the replanting of corn, tobacco, and other crops in many places.

LIMITS OF FREEZING WEATHER.

The southern and western limits of freezing weather for May, 1889, are shown on chart ii. A line representing the southern limit is traced from north-central New England south of west over the lower lakes to southern Michigan, and thence northwestward to Duluth, Minn., where it recures southwestward to southwestern New Mexico. A line showing the western limit of freezing weather is traced from east-central Arizona northwestward to southwest Oregon where it curves to the east and southeast over northwestern Utah, and is thence continued northward over western Montana into the British Possessions.

As compared with the preceding month the southern limit of freezing weather east of the Missouri Valley averages about 5° further north; in New Mexico and Arizona it is about the same; while over the plateau regions, north of the fortieth parallel, the western limit is about 5° further east.

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for May, 1889, as determined from the reports of over 2,000 stations, is exhibited on chart iii. In the table of miscellaneous meteorological data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

In May, 1889, the precipitation was greatest from central Pennsylvania southward to central Virginia, where it generally exceeded ten inches, the greatest depth of rainfall in that section, 12.41 inches, being reported at McConnellsburgh, Pa.; in west-central Illinois, 10.63 inches were recorded for White Hall; in central Missouri, along the Missouri River, 14.35 inches fell at New Frankford; in east-central Kansas 12.14 inches fell at Lebo, and at one station, Crescent City, in the extreme northwest part of California, 10.91 inches were reported. The smallest precipitation east of the Rocky Mountains was reported at Cedar Keys, Fla., where the total rainfall for the month was less than 0.01 of an inch, and at stations in the Rio Grande Valley and northeastern Dakota, where less than one-half inch fell. In the Rocky Mountain and plateau regions the rainfall exceeded three inches at stations in central Colorado and northern Montana, and in adjoining parts of western Oregon and Washington Territory the total precipitation for the month exceeded four inches. At a ma-

jority of stations in Arizona, south of the thirty-fifth parallel, and in adjoining parts of California and New Mexico no rainfall was reported. Along the Pacific coast the precipitation for the month varied from ten inches, or more, on the extreme northern coast of California, to less than two inches in northern Washington Ter., and to 0.03 of an inch at San Diego, Cal.

The precipitation for May, 1889, generally averaged above the normal in districts lying north of the thirty-fifth parallel, except from the Missouri valley southward to northern Texas, in Maine, the Canadian Maritime Provinces, the Saint Lawrence valley, the eastern lower lake and the northern upper lake regions, northern Wisconsin, and Minnesota, where it was deficient. Over a greater portion of the country lying south of the thirty-fifth parallel the precipitation was below the normal. The greatest departures above the normal occurred in the middle Atlantic states, the most marked excess, 7.21 inches, being noted at Washington, D. C. In the Missouri Valley, embracing portions of Missouri and Kansas, the total for the month exceeded the normal by more than four inches; in the southeastern part of Washington Territory by more than three inches; on the southeast coast of New England, and in the Sacramento Valley, California, by more than two inches. The greatest departures below the normal occurred over the northern extremity of Texas, and in the extreme southern part of the Mississippi Valley, where they amounted to more than four inches. At stations in the Missouri Valley, along the west Gulf and a part of the south Atlantic and Florida coasts the rainfall for the month was three inches, or more, below the normal, while in adjoin-

ing parts of Maine and New Brunswick and on the east Gulf coast the deficiencies exceeded two inches.

In districts where the precipitation was in excess the average percentages above the normal were about as follows: New England, 10 per cent.; middle Atlantic states, 52 per cent.; Ohio valley and Tennessee, 11 per cent.; lower lake region, 5 per cent.; upper lake region, 4 per cent.; upper Mississippi valley, 3 per cent.; extreme Northwest, 7 per cent.; northeastern slope of the Rocky Mountains, 26 per cent.; northern plateau region, 94 per cent.; middle plateau region, 33 per cent.; north Pacific coast, 4 per cent.; middle Pacific coast, 251 per cent. In districts where the precipitation was below the normal the percentages of the normal precipitation were about as follows: South Atlantic states, 62 per cent.; Florida, 18 per cent.; east Gulf states, 44 per cent.; west Gulf states, 55 per cent.; Rio Grande Valley, 21 per cent.; southeastern slope of the Rocky Mountains, 84 per cent.; middle eastern slope of the Rocky Mountains, 61 per cent.; southern plateau region, 6 per cent.; south Pacific coast, 87 per cent.

Among noteworthy features of the precipitation of the month were the excessive rainfall on the middle Pacific coast, where about three and one-half times the usual amount for May fell, and where in the preceding month only about one-half of the normal precipitation for April was recorded; the heavy rainfall in the middle Atlantic states, where the precipitation was about 50 per cent. in excess of the May average, and where for the preceding month nearly double the usual amount for April fell; the great deficiency in rainfall in the southern plateau region, where but about 6 per cent. of the normal amount was reported, and where in the preceding month only about one-third of the normal amount for April was reported; the marked deficiency in the Rio Grande Valley, where about one-fifth of the normal rainfall for May occurred, and where in the preceding month there was an excess of about 250 per cent. The deficiency in rainfall for Florida, the east and west Gulf states for April, 1889, continues, the amount noted for the current month in Florida being but about one-fifth of the normal for May.

A discussion of the remarkable rainfall and floods in sections of the middle states appears in this REVIEW, and a comparison of excessive monthly, daily, and hourly rainfalls with those for the corresponding month of previous years is given under the heading "Excessive Precipitation."

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for May, 1889; (4) the departure of the current month from the average; (5) and the extreme monthly precipitation for May during the period of observation and the years of occurrence:

State and station.	County.	(5) Extreme monthly precipitation for May.								
		(1) Average for the month of May.		(2) Length of record.		(3) Total for May, 1889.		(4) Departure from average.		
		Greatest.	Least.	Am't.	Year.	Am't.	Year.	Am't.	Year.	
Arkansas.										
Lead Hill.	Boone.	Inches	Years	Inches	Inches	Inches	Inches	Inches	Inches	1886
California.		6.85	7	5.32	-1.53	10.56	1882	2.04		1886
Sacramento.	Sacramento.	0.65	39	3.65	+3.00	3.65	1889	0.00		1887
Colorado.										
Fort Lyon.	Bent.	1.97	19	1.09	-0.88	4.84	1867	0.14		1866
Connecticut.										
Middletown.	Middlesex.	3.81	27	3.33	-0.48	7.63	1868	0.22		1887
Florida.										
Merritt's Island.	Brevard.	3.87	12	1.30	-2.57	8.71	1879	0.88		1886
Georgia.										
Forsyth.	Monroe.	2.98	15	1.98	-1.00	6.47	1885	0.45		1877
Illinois.										
Peoria.	Peoria.	3.79	33	3.92	+0.13	10.73	1858	0.93		1879
Riley.	McHenry.	3.78	38	4.09	+0.31	15.46	1851	0.54		1870
Indiana.										
Logansport.	Cass.	4.77	16	6.51	+1.74	11.13	1858	2.09		1881
Wayne.	Switzerland.	3.83	24	6.17	+2.35	11.50	1865	0.52		1874

Deviations from average precipitation—Continued.

State and station.	County.	(1) Average for the month of May.	(2) Length of record.	(3) Total for May, 1889.	(4) Departure from average.	(5) Extreme monthly precipitation for May.	
						Greatest.	Least.
Iowa.							
Cresco.	Howard.	3.47	17	4.18	+0.71	7.89	1880
Monticello.	Jones.	3.57	34	4.56	+0.99	7.97	1858
Logan.	Harrison.	4.40	23	3.25	-1.18	11.00	1877
Kansas.							
Lawrence.	Douglas.	4.07	23	8.27	+4.20	8.27	1880
Wellesley.	Sumner.	4.89	10	3.29	-1.60	9.37	1881
Louisiana.							
Grand Coteau.	St. Landry.	6.75	6	0.21	-6.54	14.03	1884
Maine.							
Gardiner.	Kennebec.	3.72	50	2.54	-1.18	11.76	1850
Maryland.	Allegany.	2.82	17	7.02	+4.20	7.02	1889
Massachusetts.							
Amherst.	Hampshire.	3.87	53	4.18	+0.31	8.72	1850
Newburyport.	Essex.	3.67	10	4.13	+0.46	5.58	1888
Somerset.	Bristol.	3.45	16	7.24	+2.34	5.79	1889
Michigan.							
Kalamazoo.	Kalamazoo.	4.04	13	4.86	+0.82	6.38	1883
Thornville.	Lapeer.	3.30	12	4.48	+1.18	5.64	1883
Minnesota.							
Minneapolis.	Hennepin.	3.46	23	3.06	-0.40	6.21	1879
Montana.							
Fort Shaw.	Lewis Clarke.	2.01	19	1.50	-0.51	7.19	1876
New Hampshire.	Grafton.	3.19	43	1.84	-1.35	7.37	1850
New Jersey.							
Moorestown.	Burlington.	3.88	26	4.59	+0.71	7.35	1867
South Orange.	Essex.	3.03	18	3.25	+0.22	6.46	1888
New York.							
Cooperstown.	Otsego.	3.29	35	3.96	+0.67	7.38	1867
Palermo.	Oswego.	2.66	35	1.17	-1.49	6.90	1867
North Carolina.							
Lenoir.	Caldwell.	4.85	17	6.60	+1.75	11.50	1873
Ohio.							
N. Lewisburgh.	Champaign.	3.81	17	2.75	-1.06	7.95	1882
Wauseon.	Fulton.	3.94	17	8.22	+4.28	8.22	1889
Oregon.							
Albany.	Linn.	2.78	12	3.05	+0.27	5.70	1879
Eola.	Polk.	1.95	19	2.77	+0.82	5.94	1879
Pennsylvania.							
Duberry.	Wayne.	2.82	19	4.72	+1.90	5.19	1882
Grampian Hills.	Clearfield.	3.77	17	11.60	+7.83	11.60	1889
Wellsborough.	Tioga.	5.20	10	3.45	-0.75	9.36	1884
South Carolina.							
Statesburg.	Sumter.	3.64	8	3.30	-0.34	6.68	1888
Tennessee.							
Austin.	Wilson.	3.31	21	3.65	+0.34	8.40	1882
Milan.	Gibson.	3.43	6	2.47	-0.96	4.98	1884
Texas.							
Fort Concho.	Tom Green.	2.73	15	2.28	-0.45	9.83	1884
New Ulm.	Austin.	3.56	16	2.52	-3.34	15.25	1884
Vermont.							
Stratford.	Orange.	2.96	16	3.60	+0.64	4.55	1884
Virginia.							
Bird's Nest.	Northampton.	3.64	20	3.75	+0.11	7.85	1885
Wisconsin.							
Madison.	Dane.	3.65	21	3.28	-0.37	8.39	1858
Washington.	Jefferson.	1.97	15	2.45	+0.48	7.81	1875

Table of excessive precipitation, May, 1889.

State and station.		Monthly rainfall to inches or more.	Rainfall 2.50 inches, or more, in 24 hours.	Rainfall of 1 inch, or more, in one hour.			
				Am't.	Day.	Am't.	Time.
California.							
Crescent City.		Inches.	Inches.				
Grass Valley.		10.91					
Susanville.			2.57	5			
			3.45	5			
Colorado.							
Denver (Jesuit College).							
Dakota.							
Wolsey.							
District of Columbia.							
Kendall Green.		10.73	3.12	31			
Washington City.		10.69	2.96	31			
Washington Barracks.		10.01					
Florida.							
Jupiter.							
Tallahassee.			2.70	30			
Georgia.							
Diamond.			3.25	29-30			
Gainesville.			4.75	30			
Illinois.							
Beardstown.			3.30	28-29			
Philo.			2.80	28-29			
Rockford.			2.85	18			
Rock Island Arsenal.			2.50	17			
Springfield.			3.30	28-29			
Windsor.							
White Hall.		10.63					
				1.53	1.09	19	

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall to inches, or more	Rainfall 2-50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		Day.
		Amt.	Day.	Amt.	Time.	
Indiana.	Inches.	Inches.		Inches.	h. m.	
Angola.		3.85	28-29			
Butterville.		4.02	29-30			
Huntertown.		3.12	29	3.12	3 00	29
Jeffersonville.		2.53	30			
Laconia.		2.62	29			
Mount Vernon.		2.77	28-29			
New Providence.		3.27	29-30			
Richmond.		2.68	29-30			
Rushville.		3.60	30			
Salem.		2.00	29			
Spiceland.		3.18	29-30			
Vevay.		2.50	29-30			
Indian Territory.		2.50	20			
Port Gibson.				1.12	0 55	11
Port Sill.				1.63	1 00	28
Port Supply.	Iowa.					
Clarinda.		2.65	16			
Davenport.		2.72	17			
DesMoines.		2.50	17			
Fort Madison.		2.70	17-18			
Keokuk.		2.87	17	1.36	1 10	17
Muscatine.	Kansas.	3.50	17			
Abilene.		3.60	16-17			
Atwood.		2.50	23			
Conway.		2.70	17			
Do.		3.20	28			
Cunningham.				1.57	1 10	10
Dwight.		2.50	16-17			
Elco.		3.10	28			
Ellis.		3.50	9-10			
Ellsworth.		2.60	10-11			
Fort Leavenworth.		2.54	15-16			
Fort Riley.		3.32	16-17			
Grainfield.		2.75	10-11			
Grinnell.		2.50	27-28			
Haven.		3.00	17			
Havensville.		10.00				
Hays City.		3.25	11-12			
Hoxie.		2.50	10			
Junction City.		4.09	16-17			
Kanopolis.		3.00	10-11			
Lawrence.		2.83	12			
Leavenworth.		2.51	17	1.02	0 50	10
Lebo.		4.62	28	1.04	0 50	28
Do.				1.00	1 00	24
Laray.		4.00	12-13			
Manhattan (1).		3.30	16			
Manhattan (2).		3.00	17			
Manhattan (3).		3.47	16-17			
Marmaton.		2.80	17			
Morse.		3.00	17-18			
Do.		2.70	23-24			
Ogalah.		3.50	7-8			
Peabody.		2.60	28			
Quinter.		3.50	28-29			
Russell.		2.66	9-10			
Sedan.		11.01				
Do.		3.78	10	2.80	2 30	11
Vesper.		2.80	11			
Wakefield.		3.00	11-12			
		4.25	16-17			
Kentucky.						
Franklin.		2.73	28-29			
Louisville.		2.99	29-30			
Owenton.		3.75	13			
Paducah.		2.65	30			
Maryland.						
Baltimore.						
Barren Creek Springs.		4.12	20	2.25	1 00	20
Do.				1.00	1 00	20
Cumberland (1).		3.73	31			
Cumberland (2).		3.75	31			
Fort McHenry.		11.98				
Frederick.		3.02	21			
Mount Saint Mary's College.		5.25	31			
Woodstock.		2.86	30			
Massachusetts.		10.20				
Cambridge.		10.34				
Michigan.						
Ann Arbor.		3.00	29-30			
Adrian.		3.57	29			
Berlin.		2.98	30			
Detroit.		2.57	29-30			
East Tawas.		2.50	30			
Fort Wayne.		2.90	30			
Noble.		3.12	30			
Petersburgh.		2.50	30			
Traverse City.		2.87	27			
Ypsilanti.		2.70	30			
Missouri.						
Booneville.		4.42	29			
Frankford.		3.44	28-29			
Grand Pass.		3.72	28-29			
Hermann.		2.62	29			
Kansas City.		3.24	17-18			
Kidder.		10.30				
Louisiana.		2.54	29			
New Frankford.		14.35				
Do.		9.00	28-29			
Princeton.		2.50	17-18			
		4.40	17-18			

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall to inches, or more	Rainfall 2-50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		Day.
		Amt.	Day.	Amt.	Time.	
Missouri—Continued.	Inches.	Inches.				
Shelbina.	10.70					
Wither's Mill.		4.00		28-29		
Auburn.						
New Jersey.						
Locktown.		2.85		19-20		
New York.						
Angelica.		3.04		31		
Friendship.		5.50		30-31		
Humphrey.		3.83		31		
Savona.		4.56		31		
South Canisteo.		3.37		30-31		
West Almond.		6.00		31		
North Carolina.						
Asheville (1).		3.98		30		
Asheville (2).		4.18		30		
Chapel Hill.		4.10		31		
Hatteras.		3.06		28		
Lenoir.		4.10		29-30		
Morganton.		4.95		29-30		
Raleigh.		2.79		30-31		
Southern Pines.		3.60		31		
Wadesborough.		3.50		31		
Weldon (1).		3.44		31		
Weldon (2).		3.25		31		
Ohio.						
Findlay.		3.20		30		
Fostoria.		3.20		29		
Kenton.		2.86		30		
Napoleon.		3.10		20		
Wauseon.		6.04		29 & 30		
Pennsylvania.						
Allegheny Arsenal.		2.98		10		
Altoona.		3.03		31		
Aqueduct.		5.70		31		
Blue Knob.		10.52		7.90		
Charlesville.		11.07		6.71		
Coudersport.						
Eagle's Mere.		5.40		31		
Emporium.		5.85		31		
Germantown.		11.60		8.37		
Grampian Hills.						
Harrisburg.		6.16		31		
Hollidaysburgh.						
Huntingdon.		5.12		31		
McConnellsburgh.						
New Bloomfield.		12.41		7.08		
Nisbet.		3.70		31		
Pittsburgh.		3.10		30-31		
Philipstown.		6.60		31		
Selin's Grove.		2.95		10-11		
Smethport.		3.83		30-31		
Somerset.		6.00		31		
Tipton.		5.50		31		
Tuscarora.		3.35		31		
Wyox.		5.81		30-31		
South Carolina.						
Cheraw.		2.80		31		
Florence.		4.92		31		
Spartanburgh.		3.00		30		
Statesburgh.		2.87		30-31		
Tennessee.						
Andersonville.		3.15		30		
Chattanooga.		2.75		29-30		
Hohenwald.		2.75		29		
Jacksonborough.		3.44		30		
Kingston.		3.52		30		
Kingston Springs.		2.80		29		
Nunnelly.		2.61		29		
Trenton.		3.07		29		
Watkins.		3.30		29		
Texas.						
Columbia Station.		3.07		18		
Corpus Christi.		2.68		18		
Fort Worth.		2.50		29		
Houston.		3.15		18		
La Grange.		2.60		17		
Luling.		2.53		14		
Palestine.						
Vermont.						
Coventry.		2.50		20-21		
Virginia.						
Alum Springs.		5.50		30-31		
Bolar.		6.25		30-31		
Dale Enterprise.		11.70		5.24		
Fort Myer.		11.51		4.86		
Lynchburgh.						
Petersburgh.		2.80		30-31		
Smithfield.		2.78		31		
University of Virginia.						
Wytheville.		3.00		31		
Wisconsin.		2.80		30		
Milwaukee.						
Mexico.						
Topo Chico.						
West Indies.						
Hamilton, Bermuda Island.		13.69		2.90		
Do.				7		

Monthly precipitation to equal or exceed ten inches was reported at four stations in central and south-central Pennsylvania, three stations in Maryland, three stations in the District of Columbia, three stations in central and north-central Virginia, one station in west-central Illinois, three stations in central Missouri, four stations in east-central Kansas, and one station in northwestern California. The greatest precipitation for the month, 14.35 inches, was reported at New Frankford, Mo. The voluntary observers at Hamilton, Bermuda, and Port au Prince, Hayti, report monthly precipitation 13.69 and 18.30 inches, respectively. Reports of preceding years show that precipitation to equal or exceed ten inches in May have occurred for the greatest number of years, sixteen, in Texas; for thirteen in Kansas; for ten in Iowa; for from five to nine, inclusive, in Me., N. Y., Pa., Va., N. C., Ga., Fla., Miss., La., Ark., Mo., Ill., Ind., and Nebr.; for from one to four, inclusive, in N. H., Conn., R. I., N. J., Del., Md., D. C., S. C., Ala., Tenn., Ky., Mich., Wis., Minn., Dak., Mont., Ind., T., Colo., and Wash. Ter. In states and territories other than those named reports of ten inches or more of precipitation for May have not been received. The following are notable monthly rainfalls reported for May for preceding years: Melissa, Tex., 34.85 inches in 1881, and 21.95 in 1873; Northport, Mich., 19.85 in 1884; Clarksville, Tex., 19.50 in 1873; Hudson, N. Y., 19.40 in 1876; Houston, Tex., 19.19 in 1883. Exclusive of the instances cited monthly rainfalls for May to exceed fifteen inches have been reported at stations in Arkansas in 1882; in Connecticut in 1854 and 1868; in Kansas in 1877 and 1884; in Louisiana in 1867 and 1873; in Pennsylvania in 1868; in Texas in 1873 and 1884; in Alabama in 1854 and 1882; in Florida in 1857; in Illinois in 1851 and 1872; in Indiana in 1867; in Kentucky in 1858; in Maine in 1850; in New Jersey in 1886; in Ohio in 1869; in Virginia in 1869, and in New Hampshire in 1886.

Rainfall to equal or exceed 2.50 inches in twenty-four hours was reported on a number of dates, and at thirty-five stations in Kansas; on the 10th, 11th, 30th, and 31st, and at twenty-four stations in Pennsylvania; from the 28th to 30th, and at twelve stations in Indiana; from the 28th to 31st, and at eleven stations in North Carolina; on the 17th, 18th, 28th, and 29th, and at ten stations in Missouri; from the 27th to 30th, and at ten stations in Michigan; on the 29th and 30th, and at nine stations in Tennessee; on the 30th and 31st, and at eight stations in Virginia; on several dates, and at six stations in Texas; from the 16th to 18th, and at six stations in Iowa; on the 29th and 30th, and at six stations in Ohio; on the 30th and 31st, and at six stations in New York; on the 20th, 21st, 30th, and 31st, and at six stations in Maryland. In the following-named states excessive rainfall for twenty-four hours was reported at five, or a less number of stations, and on the dates given: Illinois, 17th, 18th, 28th, and 29th; Vermont, 13th, 28th to 30th; New Jersey, 19th, 20th; District of Columbia, 31st; South Carolina, 30th, 31st; Georgia, 29th, 30th; Florida, 30th; California, 5th. In states and territories other than those named rainfall to equal or exceed 2.50 inches in twenty-four hours was not reported. The greatest amount of precipitation on one date, 7.08 inches, was reported at McConnellsburgh, Pa., on the 31st. At the following-named stations precipitation to equal or exceed 5.00 inches on one date was reported: Frederick, Md., 5.25, 31st; West Almond, N. Y., 6.00, 31st; Aqueduct, Pa., 5.70, 31st; Charlesville, Pa., 6.71, 31st; Coudersport, Pa., 5.40, 31st; Eagle's Mere, Pa., 5.17, 31st; Emporium, Pa., 5.85, 31st; Harrisburg, Pa., 6.16, 31st; Hollidaysburgh, Pa., 5.12, 31st; Pittsburgh, Pa., 6.60, 31st; Selby's Grove, Pa., 6.00, 31st; Smethport, Pa., 5.50, 31st. Among the heavier rainfalls noted for two succeeding dates were, 9.00 inches at New Frankford, Mo., 28th and 29th; 5.50 at Friendship, N. Y., 30th and 31st; 7.90 at Blue Knob, Pa., 30th and 31st; 8.37 at Grampian Hills, Pa., 30th and 31st; 5.81 at Tuscarora, Pa., 30th and 31st; 5.50 at Alum Springs, Va., 30th and 31st; 6.25 at Bolar, Va., 30th and 31st; 5.24 at Dale Enterprise, Va., 30th and 31st. At Hamilton, Bermuda, a rain-

fall of 7.07 inches fell in twenty consecutive hours on the 22d, and on the 6th the rainfall amounted to 2.90 inches. At Port au Prince, Hayti, 3.01 inches fell on the 11th, and 3.80 on the 29th and 30th. Reports of preceding years show that precipitation in May to equal or exceed 2.50 inches in twenty-four hours occurs most frequently in the Missouri and upper Mississippi valleys, in Texas, Louisiana, and along the south Atlantic coast, where this amount has been noted for ten or more years. In Florida, the east Gulf states, Dak., Colo., Tenn., Mich., Md., and Pa., for from five to nine years, inclusive, and in Me., Mass., N. Y., Conn., R. I., N. J., Del., Va., Ky., Ohio, Ind., Wis., Minn., and Mont., for from one to four years, inclusive. Over the plateau regions and along the Pacific coast rainfall to equal or exceed 2.50 inches in twenty-four hours has not been reported for May in previous years. Among the heavier daily rainfalls reported for May in preceding years are, 9.92, at Columbus, Ga., 22d, 1880; 9.28, at Durham, Ark., 1st, 1876; 7.60, at Austin, Tex., 30th, 1870; 7.50, at Okolona, Miss., 4th, 1887; 7.37, at Shreveport, La., 6th, 1876. Exclusive of the above, rainfalls to exceed 5.00 inches in one day have been reported for May at stations in Alabama in 1883 and 1885; in Dakota in 1872; in Florida in 1888; in Iowa in 1875; in Louisiana in 1884; in Maryland in 1879; in Minnesota in 1877; in Missouri in 1848; in Nebraska in 1888; in New Jersey in 1878; in North Carolina in 1887; in South Carolina in 1886; in Texas in 1880, 1884, and 1887. The heaviest rainfall ever reported in Pennsylvania for one day in May, for preceding years, was 4.60 inches at Carlisle, 13th, 1868.

Rainfalls of one inch, or more, per hour were reported as follows: Colorado, 28th, one station; Dakota, 16th, one station; Florida, 28th, one station; Illinois, 19th, one station; Indiana, 29th, one station; Indian Territory, 11th and 28th, one station each date; Iowa, 17th, one station; Kansas, 10th, 11th, 17th, 24th, and 28th, two stations on 10th, one station on each of the other dates; Maryland, 20th, three stations; Nebraska, 17th, one station; North Carolina, 28th, one station; Ohio, 20th, one station; Pennsylvania, 10th, 21st, one station on each date; Texas, 17th, two stations; Virginia, 12th and 31st, one station each date; Wisconsin, 17th, one station. In states and territories other than those named rainfall to equal, or exceed, one inch in one hour was not reported. The heaviest rate per minute of precipitation shown by the table is that given for Dale Enterprise, Va., where 1.10 inch fell in fifteen minutes. In May of preceding years rainfalls of one inch, or more, an hour have been most frequently reported in Kansas and Texas, where they have been noted for thirteen and eleven years, respectively: In N. C., S. C., Ga., Fla., Tenn., Ohio, Iowa, Mo., Nebr., for from five to ten years, inclusive; in Vt., Mass., Conn., Pa., Md., Va., Ala., Miss., La., Ark., Ind., T., Ky., Ind., Ill., Mich., Wis., Minn., Dak., Mont., and Colo. for from one to four years, inclusive. In other states and territories rainfalls to equal this amount for the period given have not been reported. Remarkable rainfalls for one hour, or less, have been noted for May in preceding years as follows: Fort McPherson, Nebr., 1.50 inch in five minutes, and 2.25 inches in forty minutes, 27th, 1868; New York City, 1.15 inch in ten minutes, 22d, 1881; Mount Ida, Ark., 1.20 inch in ten minutes, 10th, 1882; Davenport, Iowa, 0.50 inch in ten minutes, 3d, 1888; Collinsville, Ill., 1.70 inch in twelve minutes, 23d, 1888; Toledo, Ohio, 1.10 inch in fifteen minutes, 20th, 1880; Embarras, Wis., 2.30 inches in fifteen minutes, 28th, 1881; Mobile, Ala., 1.64 inch in twenty minutes, 5th, 1879; Fort Riley, Kans., 1.50 inch in twenty minutes, 14th, 1885; West Leavenworth, Kans., 1.50 inch in twenty minutes, 13th, 1886; Palestine, Tex., 1.17 inch in twenty-three minutes, 24th, 1888; College Hill, Ohio, 2.38 inches in thirty minutes, 27th, 1888.

MAXIMUM RAINFALLS IN ONE HOUR OR LESS.

The following is a record of the heaviest rainfalls during May, 1889, for periods of five and ten minutes, and one hour, as reported by regular stations of the Signal Service furnished with self-registering gauges:

Station.	Maximum fall in—						Maximum rate per minute.
	5 min.	Date.	10 min.	Date.	1 hour.	Date.	
Boston, Mass.	.10	20	.15	20	.65	20	.02
Cincinnati, Ohio	.10	29	.15	29	.45	29	.02
Chicago, Ill.	.08	26	.11	26	.35	26	.016
Detroit, Mich.	.48	16	.50	16	.60	16	.096
Dodge City, Kans.	.07	27	.12	27	.50	27	.014
Jupiter, Fla.	.12	25	.23	28	1.15	28	.024
New York City	.07	20	.12	20	.25	20	.014
Philadelphia, Pa.					1.00	20	.05
San Francisco, Cal.	.30	5	.30	5	.40	5	.06
Saint Louis, Mo.	.20	26	.25	26	.30	29	.04
Washington, D. C.	.25	31	.30	20	.80	20	.05

* During a thunder-storm.

† Fell in twenty minutes.

This table shows that the greatest rate of precipitation for a five-minute period was .096 of an inch at Detroit, Mich., during a thunder-storm on the 16th, and that at San Francisco, Cal., rain fell at the rate of .06 per minute for a five-minute period on the 5th. At Washington, D. C., .05 of an inch per minute was registered for five minutes on the 31st, and at Philadelphia, Pa., this rate was equalled for twenty minutes on the 20th. At Saint Louis, Mo., .20 of an inch fell in five minutes on the 26th, giving a rate per minute of .04 of an inch. The only other stations whose reports appear in the table, giving excessive amounts of rainfall for the periods given, are Boston, Mass.; Cincinnati, Ohio, and Jupiter, Fla., where rain fell at the rate of .02 of an inch per minute for five-minute periods on the 20th, 29th, and 28th, respectively.

SNOW.

Snow was reported on the greatest number of dates, thirteen, in Montana; on eleven in Colorado and Dakota; on eight in Michigan; on six in Oregon and Wyoming; on five in Nevada; on four in California; on three in Illinois, Minnesota, and Utah; on two in Nebraska and Wisconsin, and on one in Kansas, New York, and Pennsylvania. It was reported in the greatest number of states and territories, eight, on the 15th; in seven on the 6th; in six on the 1st, 2d, and 7th; and in from one to five, inclusive, on the 3d to 5th, 8th to 12th, 14th, 16th to 19th, 21st, 22d, 24th, and 28th to 31st.

No snow was reported on the ground at the close of the month.

MONTHLY SNOWFALLS (inches and tenths) MAY, 1889.

Below are given all monthly snowfalls reported:

California.—Cisco, 67; Summit, 63; Emigrant Gap, 50; Truckee, 45; Boca, 39; Fort Bidwell, 7; Dunsmuir, 5; Coles, 2. *Colorado.*—Breckenridge, 46; Georgetown, 39; Palmer Lake, 3.8; Bennet and Fort Collins, 2. *Dakota.*—Fort Buford, 13.5; Carrington, 7.5; Steele and Bismarck, 6; Fort A. Lincoln, 4.5; Napoleon, 1.5; Rapid City, 1.3; Davenport, trace. *Illinois.*—Centralia, Chicago, Flora, Olney, Ottawa, and Richview, trace. *Indiana.*—Huntingburgh, Mount Vernon, and Seymour, trace. *Michigan.*—Kalamazoo and Mottville, 2.5; Lansing, 1.5; Marquette, 0.7; Alpena and Grand Haven, trace. *Minnesota.*—Duluth, 0.5; Brainard and Farmington, trace. *Montana.*—Fort Custer, 10; Camp Poplar River, 5.4; Fort Logan, 4; Virginia City, 3; Glendive, 1; Fort Keogh, 0.2. *Nebraska.*—Hay Springs, 2; Kimball, 1. *Nevada.*—Wellington, 18; Verdi, 11; Eureka, 10.9; Elko, 10; Tuscarora, 9.5; Pioche, 8.5; Ely, 7.5; Belmont and Virginia City, 6; Lewer's Ranch, 5; Wells, 3.5; Carson City *a*, 3.2; Mill City, 3; Toano, 2.8; Austin, 2.5; Reno State University, 2.2; Punch Bowl, 2; Carson City *b*, 1.5; Fort McDermitt and Genoa, 1; Ruby Hill and Winnemucca, trace. *New York.*—Humphrey, 1. *Oregon.*—Siskiyou, 17; Fort Klamath, 6.6. *Utah.*—Fort Douglas, 4. *Wisconsin.*—Fredonia, 1.8; Waucousta, 1; Greenwood, trace. *Wyoming.*—Cheyenne, 14; Fort Bridger, 13.9; Fort D. A. Russell, 3; Forts Laramie and Washakie, 2.0; Camp Pilot Butte, 1; Camp Sheridan, 0.7.

HAIL.

Descriptions of the more severe hail-storms of the month are given under "Local storms." Hail was reported during the month as follows:

1st., Mass., N. C., Oregon. 2d, Md., Oregon. 3d, Mass., N. Y., Tenn. 4th, Me. 5th, Mass., N. Mex., Oregon. 6th, Kans., La., N. C., Va. 7th, Kans., Nebr., Utah. 8th, Cal., Kans., Mich., N. J., Tex. 9th, Ariz., Iowa, Kans. 10th, Ill., Pa. 11th, Ill., Ind. T., Iowa, Kans., Mo., Nebr., N. Y., Ohio, Tex. 12th, Ala., Ill., Ind., Ky., Mo., N. Y., Ohio, Pa., Tenn., Tex., Va. 13th, Ala., Cal., Ga., Idaho, Iowa, Ky., La., Mass., Nev., Oregon, Tex. 14th, Ala., Cal., Dak., D. C., Miss., Nebr., N. C., Va. 15th, Cal., Nev., Oregon. 16th, Ark., Cal., Colo., Dak., Iowa, Kans., Minn., Nebr., Wis., Wyo. 17th, Iowa, Kans., Tex. 18th, Ill., Iowa, Kans., La., Mo., Tex. 19th, Dak., Iowa, N. Y., Wis., Wyo. 20th, Mass., N. Y., Tenn. 21st, Mass., Mont., N. H., N. Mex. 22d, Dak., Va., W. Va. 23d, Ala., Iowa, Kans., Mich., Mo., N. C., Wis. 24th, N. Y., Ohio, S. C., Tenn. 25th, N. Mex., N. C., Ohio, S. C., Tenn. 26th, Conn., Dak., Kans., Tex., Va. 27th, N. Y., Wis. 28th, Cal., Ind. T., Nebr., N. C. 29th, Ind. T., Pa., Tex. 30th, Dak., Mont., Tex. 31st, Wis.

SLEET.

Sleet was reported as follows: 1st, Colo. 5th, Oregon. 7th, Utah. 8th, Nev. 9th, Wyo. 10th, Colo. 15th, Utah. 16th, Colo. 22d, Pa. 28th, Mich. 30th, Mich., Wis.

THE JOHNSTOWN FLOOD.*

[By T. RUSSELL, Assistant Professor, Signal Service.]

The rainfall of May 30, 31, and June 1, 1889, in western and central Pennsylvania was unprecedented for that section of country. All the observations of depth of rainfall that could be obtained which were made during those three days are given in the accompanying table, together with the time of beginning and ending of the rain and its duration. The table also includes the adjoining regions in Maryland, the Virginias, Ohio, and New York. The observations comprise those made at the regular Signal Service stations, the river gauge, and special rainfall stations of the Signal Service, and those made by the Pennsylvania and Ohio State Weather Services and by voluntary observers.

These depths of rainfall were plotted on chart v, drawn to a scale of $\frac{1}{200000}$, or about twenty-eight miles to one inch. Lines were drawn through the places having equal depths of rainfall. These lines are shown by the solid black lines for every two inches from two up to ten inches. The dotted lines on the map show the boundaries of the catchment basins of the Susquehanna River, the Potomac River above Washington, and the basin of the Monongahela and Allegheny Rivers above Pittsburgh. The small area about Johnstown, which is the catchment basin of Conemaugh and Paint Creeks, is also shown.

The latter area is also shown on a larger scale, about $\frac{1}{53440}$, or one inch to four miles on chart vii. The small area inside the large one shows the area which drained into the reservoir above the dam on the South Fork, which gave way and caused the disaster at Johnstown. This area is about fifty-two square miles. On this map are shown the depths of rainfall at Blue Knob and Somerset. There is not a single complete observation of rainfall inside of the Johnstown area. The figure, 2.00 inches, given for Johnstown, is only a part of the rainfall. The rain-gauge was carried away by the high water at 10.44 a. m., May 31st. The creek at that time was twenty feet above low water. There was a subsequent observation of the creek at fourteen minutes after 12 o'clock, which reads as follows: "Water higher than ever known; can't give exact measurement."

The dam on the South Fork gave way at 1 p. m., and the city of Johnstown was overwhelmed by the flood at 3 p. m. Mrs. H. M. Ogle, who held the position of Signal Service observer there since November 1, 1884, was lost in the great catastrophe.

The areas between the rainfall lines on chart v were measured with a planimeter, and from these, with the depths of rainfall, the quantity of water that fell was computed.

These quantities are as follows:

* Possible additions and corrections may follow.

Areas of valleys and quantity of rainfall May 30, 31, and June 1, 1889.

Valleys.	Square miles.	Cubic miles of water.
Susquehanna Valley	26,070	1.895
Potomac Valley	12,050	1.005
Allegheny and Monongahela Valley	18,840	0.837
Johnstown Valley	628	0.0615
Valley above South Fork Dam	52	0.0065

In computing the quantity of rainfall in the Johnstown Valley, given above, it was assumed that the depth of rainfall was 6.2 inches throughout. This is the mean of the observations at the nearest points to the valley—Blue Knob on the east, with a fall of 7.9 inches, and Somerset on the south, with a fall of 4.33 inches.

If the average length of the reservoir was three miles, its width two miles, and its depth forty feet, it would have contained a volume of water equal to 0.045 of a cubic mile. (These dimensions are only approximations.)

All of the rainfall that fell in the drainage basin of the reservoir would only have sufficed to raise its surface 5.3 feet.

The rain lasted about thirty-two hours. Not more than three-fourths of the rainfall (0.0615 of a cubic mile) in the Johnstown Valley had fallen up to 3 o'clock of the 31st. Assuming that nine-tenths of the rainfall reached the streams, only one-tenth being absorbed by the ground, this would leave 0.0414 of a cubic mile, the greatest part of which must have taken considerably longer to flow by Johnstown than the length of time the rain lasted.

On the morning of May 30th the Johnstown river-gauge (7.44 a. m.) read 1.0 foot above low water. On the 31st, at the same time, it read fourteen feet; at 10.44 it read twenty feet.

That part of the river-flow past Johnstown from 3 to 5 p. m. on the 31st (which came simply from the rainfall over the drainage area, leaving out of account the water from the res-

ervoir) may be taken as a part of the whole rainfall proportional to the time. This would give the flow of the river proper for the time, 3 to 5 p. m., as 0.0034 of a cubic mile.

The greater part of the water from the reservoir, equal to about .0450 of a cubic mile, must have passed Johnstown about the same time, from 3 to 5 p. m.

From this it may be inferred that the rainfall-water passing at the time, though great, did not have much significance in causing the disaster, as it was probably not more than one-tenth of that from the reservoir.

This great rainfall, 1.1 of a cubic mile in the Susquehanna Valley and 1.0 cubic mile in the Potomac Valley, occurred to the northeast of a definite low area of barometer, that designated as No. viii. The lowest barometer (29.58) was at Cincinnati at 8 a. m. of the 30th. The 29.6, 29.7, 29.8, and 29.9 inch isobars were regular and the areas they enclosed oblong in shape, with the longer axes running north and south. The region of greatest pressure gradient was to the northwest of the low area on the morning of the 30th. It increased from 29.58 at Cincinnati to 30.38 at Duluth. There was also an increase of pressure toward the northeast. At Halifax it was 30.38. The temperature gradient to the northeast of the low area, the region of heavy rainfall, was also great. The isothermal lines ran from southwest to northeast, and there was a uniform increase in temperature from 40° in the lake region to 70° on the Atlantic coast. It is altogether likely that this great temperature gradient had something to do with the heavy rainfall. The winds in the region of heavy rainfall were from the southeast during the continuance of the storm, and in the lake region, from the northeast.

The broken, black lines on chart vi show the time of the beginning of the rain on May 30th. The times of beginning are not very concordant, but there is a preponderance of observations showing the progress of the rain to be from the Atlantic coast inland, and from the south towards the north.

Table of Observations of Depth of Rainfall.

Station.	Latitude.	Longitude.	May 29.	May 30.	May 31.	June 1.	Total rainfall (May 30 to June 1).	Time of beginning.	Time of ending.	Duration.
Pennsylvania.										
Brookville	N. 41° 10'	W. 79° 07'	.....	.....	.....	.....	.....	May 30, 1.30 p. m.	June 1, 7.00 a. m.	41 1/2
Clarion	41° 17'	79° 26'	.....	1.40	1.62	0.01	3.03	May 30, 2.00 p. m.	May 31, 21.00 a. m.	21
Confluence	39° 45'	79° 20'	.....	.....	1.14	.....	1.14	May 30, 4.30 p. m.	May 31, 7.00 p. m.	26 1/2
Corry	41° 55'	79° 37'	.....	0.07	0.74	0.34	1.15	May 29, 10.00 p. m. ....	.....	.....
Coudersport	41° 46'	78° 05'	.....	.....	5.40	.....	5.40	May 30, 5.00 p. m. ....	.....	.....
Edinborough .....	.....	.....	.....	.....	.....	.....	.....	May 30, 6.30 p. m.	May 31, 9. ....	.....
Franklin	41° 25'	79° 53'	.....	0.10	0.81	0.05	0.97	May 30,	May 31, ....	.....
Freepoirt	40° 42'	79° 43'	.....	.....	1.80	0.05	1.85	May 30, 3.00 p. m.	June 1, 8.00 a. m.	41
Greensburg	40° 20'	79° 23'	.....	.....	1.70	0.05	1.75	May 30, 6.00 p. m.	June 1, 8.00 a. m.	35
Indiana	40° 39'	79° 13'	1.20	2.00	1.00	T.	3.00	May 30, 2.00 a. m.	May 31, 7.30 p. m. ....	.....
Johnstown	40° 20'	79° 00'	.....	.....	2.00	.....	2.00	.....	.....	.....
Lock No. 4	40° 10'	79° 55'	.....	.....	1.40	0.02	1.42	May 30, 9.00 p. m.	June 1, 7.00 a. m.	34
Mahoning	40° 55'	79° 30'	.....	T.	0.64	0.52	1.16	May 30, 30.00 a. m.	June 1, 8.30 a. m.	52 1/2
Oil City	41° 26'	79° 42'	.....	.....	1.03	0.27	1.30	May 30, 2.30 p. m.	June 2, 9.00 a. m.	36
Parker's Landing	41° 10'	79° 45'	.....	.....	1.02	0.14	1.16	May 30, 2.00 p. m.	June 1, 4.00 a. m.	35
Pittsburgh	40° 27'	80° 01'	T.	1.44	T.	0.00?	1.44	May 30, 4.10 a. m.	May 31, 6.30 p. m.	27 1/2
Saltsburgh	40° 18'	79° 50'	.....	.....	1.94	0.02	1.96	May 30, 2.30 p. m.	May 31, 6.00 p. m.	27 1/2
Smethport	41° 50'	78° 26'	.....	.....	5.50	.....	5.50	May 30, 11.00 p. m.	May 31, 6.00 p. m.	27 1/2
Somerset	40° 01'	79° 07'	.....	.....	4.43	.....	4.43	May 30, 10.00 p. m.	May 31, 10.00 a. m.	12
Uniontown	39° 55'	79° 44'	.....	.....	2.07	0.04	2.11	May 30, 8.30 p. m.	May 31, 8.30 a. m.	27
Warren	41° 52'	79° 13'	.....	.....	1.76	0.62	2.58	May 30, 6.00 p. m.	May 31, 9.00 p. m.	27
Meadville	41° 38'	80° 10'	.....	.....	1.35	.....	1.35	.....	.....	.....
Altoona	40° 31'	78° 27'	.....	.....	3.03	2.30	5.33	May 30, 3.30 p. m.	June 1, 3.30 a. m.	36 1/2
Blue Knob	40° 20'	78° 35'	T.	.....	7.90	.....	7.90	May 30, 3.20 p. m.	May 31, 9.00 p. m.	29 1/2
Carlisle	40° 12'	77° 13'	.....	0.05	1.40	1.50	1.95?	May 30, 7.20 a. m.	June 1, early a. m.	24
Eagle's Mere	41° 25'	76° 36'	.....	0.36	5.17	5.53	5.53	May 30, morning.	June 1, 4.10 a. m.	36 1/2 or 32?
Emporium	41° 30'	78° 18'	.....	0.12	5.85	5.97	5.97	May 30, 9.30 p. m.	May 31, 11.20 p. m.	24
Grampian Hills	40° 58'	78° 40'	.....	0.23	5.37	8.60	8.60	May 30, 4.30 p. m.	May 31, 11.20 p. m.	24
Harrisburg	40° 16'	76° 54'	.....	.....	0.42	7.56	7.98	May 30, 1.35 p. m.	June 1, 2.00 a. m.	33 or 35?
Huntingdon	40° 29'	78° 03'	.....	0.60	4.22	1.75	6.57	May 30, 4.00 p. m.	May 31, 12.00 p. m.	35?
Hollidaysburgh	40° 27'	78° 26'	.....	2.11	3.99	6.10	6.10	May 30, 8.00 p. m.	June 1, 7.00 a. m.	35?
Le Roy	41° 49'	76° 48'	.....	0.08	2.00	2.36	4.44	May 30, 5.00 p. m.	June 1, 2.00 a. m.	31
Lock Haven	41° 08'	77° 31'	.....	.....	3.10	4.00	7.10	May 30, 3.00 p. m.	June 1, 4.00 a. m.	31
Nisbet	41° 13'	77° 14'	.....	.....	6.60	.....	6.61	May 30, 3.00 p. m.	May 31, 11.50 p. m.	33
Pittsburgh	40° 33'	76° 05'	.....	0.01	2.83	3.86	5.69	May 30, 3.50 p. m.	June 1, 5.00 a. m.	35?
Philippsburg	40° 53'	78° 17'	T.	.....	6.00	1.07	7.53	May 30, 4.00 p. m.	June 1, 4.00 a. m.	35?
Selin's Grove	40° 50'	77° 55'	.....	0.46	2.35	1.94	5.04	May 30, 3.45 p. m.	June 1, before dawn.	35?
State College	40° 47'	77° 55'	.....	0.75	3.35	4.15	4.15	May 30, 4.00 p. m.	June 1, 1.30 a. m.	33 1/2
Tipton	40° 57'	78° 20'	T.	0.80	.....	0.72	May 30, 10.00 p. m. ....	.....	.....	.....
Erie	42° 07'	80° 05'	.....	.....	3.50	.....	3.50	May 30, 5.00 p. m.	June 1, 4.00 a. m.	35
Troy	41° 47'	76° 50'	.....	.....	9.50	.....	9.50	May 30, 9.15 a. m.	June 1, 4.20 a. m.	33
Wellsbrough	41° 45'	77° 21'	.....	0.65	1.70	7.45	3.21	May 30, 7.00 p. m.	June 1, 5.00 a. m.	34
York	39° 58'	76° 41'	.....	0.02	1.49	1.70	May 30, 2.00 p. m.	During night 31? ....	.....	.....
Butler	40° 52'	79° 55'	.....	.....	1.22	May 30, evening. ....	.....	.....	.....	.....
Greenville	41° 22'	80° 35'	.....	.....	2.25	May 30, 3.00 p. m.	June 1, 9.30 p. m. ....	.....	.....	33
New Castle	41° 02'	80° 24'	.....	0.61	6.71	0.18	7.50	May 30, 4.00 p. m.	May 31, 10.00 p. m.	33
Charlesville	39° 55'	78° 32'	.....	1.23	7.08	8.31	8.31	May 30, 4.00 p. m.	May 31, 12.00 p. m.	33 or 33
McConnellsburgh	39° 55'	78° 01'	.....	1.23	7.08	.....	.....	.....	.....	.....

Table of Observations of Depth of Rainfall—Continued.

Station.	Latitude.	Longitude.	May 29.	May 30.	May 31.	June 1.	Total rainfall (May 30 to June 1).	Time of beginning.	Time of ending.	Duration.	
Pennsylvania—Continued.											
Catawissa	40° 58'	76° 30'		Inches.	Inches.	Inches.	Inches.			Hours.	
Drifton	41° 02'	75° 45'		0.44	2.08	0.36		4.81			
Girardville	40° 48'	76° 18'						2.88			
Meyerstown	41° 51'	76° 08'						1.54			
Lancaster	40° 03'	76° 18'		0.23	0.50			1.75			
Pottstown	40° 15'	75° 38'			1.70			0.73	May 30, 2:50 p. m.	May 31, (?)	
Quakertown	40° 26'	75° 21'						1.70	May 31, 6:00 a. m.	May 31, 10:00 p. m.	
Forks of Neshaminy	40° 14'	75° 08'		0.04	0.50			0.11	May 31, 6:33 a. m.	May 31, 2:20 p. m.	
Dyberry	41° 46'	76° 27'		0.11	0.35			0.54	May 30, 11:15 a. m.	May 31, (?)	
Wysox	40° 20'	75° 55'						0.46	May 30, 4:00 p. m.	May 31, 6:00 p. m.	
Reading	40° 37'	75° 23'						3.22	May 30, 4:30 p. m.	May 31, during night	
Bethlehem	39° 51'	75° 43'						0.04			
Kennett Square	39° 59'	75° 50'						0.02			
Coatesville	41° 35'	75° 20'		0.07	0.50			0.01			
Honesdale	39° 55'	75° 22'						0.01?			
Swarthmore	39° 57'	75° 09'						0.57			
Philadelphia	39° 57'	75° 42'						0.09			
West Chester	39° 57'	75° 42'						0.46			
Mercersburgh	39° 49'	77° 56'						0.50			
Columbus	41° 55'	79° 39'						1.41?			
New Bloomfield	40° 25'	77° 13'						0.81?	May 30, 10:00 p. m.		
Point Pleasant	40° 25'	75° 04'		0.05	0.46			4.07			
Bedford	40° 02'	78° 31'						0.51			
Chambersburgh	39° 56'	77° 42'						May 30, 3:00 p. m.			
Bendersville	39° 59'	77° 20'						May 30, 2:00 p. m.			
Gettysburg	39° 50'	77° 16'						May 30, 3:30 p. m.			
Bellefonte	40° 24'	77° 50'						May 30, 3:00 p. m.			
Lewiston	40° 36'	77° 36'						May 30, 5:00 p. m.			
Sigerville	40° 44'	77° 34'						May 30, 4:00 p. m.	June 1, 2:00 a. m.	34	
Yeagerstown	40° 38'	77° 37'						May 30, 3:00 p. m.	June 1, 1:00 a. m.	34	
Williamsport	41° 15'	77° 04'						May 30, 5:00 p. m.	June 1, 2:00 a. m.	33	
Elston	41° 37'	77° 01'						May 30, 9:00 p. m.	June 1, noon	32?	
Muncy								May 31, 1:00 a. m.	June 1, noon	36	
Frederick	40° 17'	75° 31'		0.01				0.01	May 31, 3:00 a. m.		
Ottsville	40° 27'	75° 09'		0.05	0.48			0.53	May 30, 3:00 p. m.		
Smith's Corner	40° 25'	75° 07'		0.05				0.05	May 30, 10:45 a. m.		
Doylestown	40° 17'	75° 08'		0.20				0.20	May 30, 10:00 p. m.		
Germantown					0.51			0.51	May 30, 1:30 p. m.		
Marshall's Creek	41° 03'	75° 06'		0.10	0.50			0.60	May 31, 6:00 p. m.		
Virginia.											
Alum Springs	37° 50'	79° 42'					5.50	May 30, 11:30 a. m.	May 31, 7:00 a. m.	19	
Bolivar	38° 15'	79° 45'					6.25	May 30, 12:00 m.	May 31, 8:00 a. m.		
Lynchburgh	37° 25'	79° 09'		2.00	0.84		2.84	May 30, 10:45 a. m.	May 31, 4:47 p. m.	18	
Fredericksburgh	38° 18'	77° 27'						5.25	May 30, 10:00 p. m.	June 1, 8:00 a. m.	34
Dale Enterprise	38° 28'	78° 53'		1.50	3.74		5.24	May 30, 1:30 p. m.	May 31, 6:00 p. m.	16	
Norfolk	36° 51'	76° 17'		0.26	0.62		0.88				
Maryland.											
Baltimore	39° 18'	76° 37'		0.10	2.28	T.	2.38	May 30, 5:30 a. m.			
Washington, D. C.	38° 54'	77° 03'		0.58	3.10		3.68	May 30, 2:00 p. m.			
Cumberland	39° 39'	78° 45'			3.73	0.20*	3.93	May 30, 11:59 p. m.	May 31, at night		
Frederick	39° 27'	77° 22'		0.59	5.25		5.84				
Mount Saint Mary's College	39° 43'	77° 12'	0.90	2.86	1.92		4.78	May 29, during night.	May 31, 11:30 p. m.		
Fallston	39° 31'	76° 25'		0.05	1.25	1.25	2.55	May 30, 7:30 a. m.	June 1, 5:00 a. m.	45	
Jewell	38° 47'	76° 34'			T.	2.12	2.12	May 31, 9:00 p. m.	June 1, early morning		
McDonough	39° 24'	76° 45'		0.05	1.90	1.65	3.60	May 30, evening	May 31, late at night.		
Woodstock	39° 19'	76° 50'		0.39	4.69		5.08	May 30, 12:10 p. m.	June 1, 1:00 a. m.	25	
West Virginia.											
Buckhannon	38° 57'	80° 16'				1.86	1.86	May 31			
Clarksburgh	39° 16'	80° 22'				1.64	1.64	May 30, during night.			
Edon	39° 09'	79° 37'	1.00			3.00	1.00	4.00	May 29, 3:00 p. m.	June 1, 7:00 a. m.	
Kingwood	39° 27'	79° 45'						5.00	May 30, 1:00 p. m.	June 1, 9:00 a. m.	44
Morgantown	38° 30'	79° 45'				1.92	0.03	1.95	May 30, night		
Pleasant Hill	39° 33'	79° 40'						May 30, all day			
Rivesville	39° 30'	80° 10'		0.50	1.50			May 30, 4:00 p. m.	May 31, 9:00 a. m.		
Rowlesburgh	39° 25'	79° 40'			0.55	0.30		2.00	May 30, (?).	June 1, (?).	17
Weston	39° 00'	80° 35'			0.15			0.85	May 30, afternoon	June 1, morning.	
Parkersburgh	39° 17'	81° 34'			1.48			0.15	May 30, 6:40 a. m.	May 31, 9:00 p. m.	
Charleston	38° 25'	81° 40'						1.48	May 30, 12 noon	May 31, 11:00 p. m.	36
Piedmont	39° 27'	79° 06'						1.96	May 30, a. m.	June 1, 1:00 a. m.	37?
Martinsburgh	39° 28'	77° 57'						1.96	May 30, a. m.	May 31,	
Hinton	37° 50'	81° 00'		0.01	1.95			2.25			
Grand Tower	39° 20'	77° 40'						2.15	May 30, 4:00 p. m.	May 31, 8:00 a. m.	16
Glenville	38° 56'	80° 55'		2.15				1.30	May 30, 2:35 p. m.	May 31, before daybreak.	
Wheeling	40° 00'	80° 40'			1.30			0.45			
Catlettsburgh, Ky.	38° 30'	82° 37'		0.05	0.40						
New York.											
Albany	43° 39'	73° 45'					0.50				
Buffalo	42° 53'	78° 53'					1.93	May 30, 8:00 p. m.	May 31, 8:00 p. m.	24	
Humphrey	42° 12'	78° 33'		0.23	3.83	0.66	4.72	May 30, night	May 31, night	24	
New York City	40° 43'	74° 00'					0.52	May 30, 6:30 a. m.	May 31, 11:35 a. m.	18	
Elmira	42° 04'	76° 50'		0.37	1.05	1.50	2.92	May 30, 5:30 p. m.	June 1, 7:30 a. m.	38	
Factoryville	42° 10'	76° 15'		0.10	1.49	1.37	2.96	May 31, 2:30 a. m.	June 1, 11:00 a. m.	44 1/2	
Savona	42° 37'	77° 17'		0.41	4.50		4.97	May 30, 7:30 p. m.	June 1, 3:30 a. m.	32	
South Canisteo	42° 13'	77° 35'		0.25	3.12	4.50	7.87	May 30, 6:10 p. m.	June 1, early a. m.	34?	
West Almond	42° 19'	77° 55'			5.00			5.00			
Rochester	43° 08'	77° 42'		0.58	2.34		2.92	May 30, 7:05 p. m.			
Oswego	43° 29'	76° 35'		0.01	2.66	0.40	3.07	May 30, 6:35 p. m.	May 31, 11:45 p. m.	29	
Ohio.											
Cincinnati	39° 06'	84° 30'	1.48	0.10			0.10	May 30, 9:15 p. m.	May 31, 3:00 p. m.	18	
Columbus	39° 55'	83° 00'	1.06	0.50	0.26		0.76	May 29, 4:55 p. m.	May 31, 1:30 a. m.		
Ellsworth	41° 05'	80° 55'		T.	1.30		1.30				
Jefferson	41° 44'	80° 45'	0.10	1.44	0.29		1.73				
Lordstown	41° 11'	80° 55'	0.12	1.06	T.		1.06				
Orangeville	41° 20'	80° 35'				1.25					
Poland	41° 02'	80° 40'	0.10	1.00	0.10		1.10				
Vienna	41° 15'	80° 43'	0.04	1.03			1.03				
Youngstown	41° 06'	80° 39'	T.	1.03	0.02		1.03				
Demos	40° 01'	81° 04'		1.11			1.11				
New Alexandria	40° 18'	80° 45'		T.	1.16		1.16				
Salineville	40° 39'	80° 52'			2.00		2.00				
Cleveland	41° 30'	81° 45'	1.36	0.98			2.34	May 30, 3:15 p. m.			
Gallipolis	38° 54'	82° 16'		0.08	0.87		0.95				

WINDS.

The prevailing winds during May, 1889, are shown on chart i by arrows flying with the wind. In New England, the lower lake region, and the southeastern slope of the Rocky Mountains south to west winds were most frequently noted. In the middle Atlantic states and over the northeastern slope of the Rocky Mountains they were mostly from north to west. In the south Atlantic states and along the north and middle Pacific coasts, northwest to southwest; in Florida, and over the middle-eastern slope of the Rocky Mountains and the middle plateau region, variable; in the east and west Gulf states, Rio Grande Valley, Ohio valley and Tennessee, the upper lakes (except over Lake Superior), and the upper Mississippi and lower Missouri valleys, southerly; over Lake Superior, in the extreme Northwest, and the upper Missouri valley, northeast to northwest; over the southern and northern plateau regions, west to southwest, and on the south Pacific coast, west to northwest.

HIGH WINDS (in miles per hour).

Maximum velocities of fifty miles, or more, per hour, other than those given in the table of miscellaneous meteorological data, have been reported as follows: Fort Elliott, Texas, 53, s., 6th; 52, se., 16th. Dodge City, Kans., 50, s., 4th. Fort Stanton, N. Mex., 52, w., 6th. Whipple Barracks (Prescott), Ariz., 52, sw., 6th.

LOCAL STORMS.

May, 1889, was characterized by unusually severe storms over the central and eastern districts. The remarkable precipitation and resultant floods which occurred in sections of the middle Atlantic states during the last two days of May and on June 1st constitute meteorological features of exceptional interest, and form the subject of a special paper in this REVIEW. The general meteorological conditions which attended the storms in the districts referred to are shown by four charts printed on the back of chart i, which represent, respectively, the results of observations taken at Signal Service stations at 8 p. m. of May 30th, 8 a. m. and 8 p. m. of May 31st, and 8 a. m. of June 1st, and the excessive rainfall and floods of that period are treated generally under their respective headings. The conditions presented by the 8 a. m. reports of May 30th called for the following general forecast, which was printed on the weather map issued by this office on the morning of that date: "Rain will prevail in New England, the lower lake region, southern Michigan, and thence southward to the south Atlantic and east Gulf states, with severe local storms in the middle, south Atlantic, east Gulf states, and the Ohio Valley."

The following descriptions of storms generally refer to disturbances which attended the passage of areas of low pressure traced on chart i:

1st. North Carolina.—Grover, Cleveland Co.: a cloud rose in the northwest at 5 p. m.; it suddenly turned very dark and appeared like smoke rising from a huge oil tank on fire. A yellowish cloud followed closely after, accompanied by heavy rain, hail, and high wind, unroofing and demolishing houses, leveling fences, and blowing down timber and orchards in this section. The path of the storm was about one-half mile wide and six miles long.—*Report of F. H. Dover.* Wilmington: reports from Warsaw, Duplin Co., a small town fifty miles north of this city, state that that place was visited at 4 p. m. by a terrific storm from the southeast, accompanied by rain, hail, and high wind, lasting but one or two minutes. Hail fell four to six inches in depth, and for the very short duration of the wind an almost incredible amount of damage is reported. One church and twenty houses were blown down, and of the church only the pulpit and one chair were left on the site. The estimated damage to property, cattle, and crops was between \$15,000 and \$20,000.

6th. Oregon.—Portland: at 6 p. m., a vast, oval-shaped, hollow cone of inky-black clouds appeared a few miles north

of station, moving slowly in a southeasterly course. The cone covered one-fourth of the sky and extended from the zenith to within about 1,000 feet of the earth. The mouth of the cone, near the earth, had well-defined but ragged edges of dark gray clouds which seemed to be whirling rapidly from right to left around the dark open centre of the immense funnel. At 6.15 p. m. the funnel seemed to dissipate into a thick, inky mass of clouds slowly moving towards the mountains in the southeast. No lightning was seen, and distant thunder was only heard twice while the phenomenon lasted. **Minnesota.**—Moorhead: the wind, which was high from the southwest during the afternoon, became very severe at 6.35 p. m., when an extreme velocity of seventy-two miles was recorded, the duration of which did not exceed forty-five seconds. Several out-houses, chimneys, etc., were blown down. The storm moved from southwest to northeast, and was accompanied by several brilliant flashes of lightning and heavy thunder. **Kansas.**—Hutchinson, Reno Co.: a terrible storm occurred near Stafford, Stafford Co., about 8 p. m., in which one man was instantly killed and about thirty persons were seriously injured; houses were demolished, barns torn down, and in places the growing crops were blown from the ground. The wind had been blowing a perfect gale for three days all over western Kansas, but the destructive path of the storm was confined to a narrow strip beginning in Stafford county, and extending in a northwesterly direction through Rice county.—*The (Mexico, Mo.) Republic, May 7.* Sterling, Rice Co.: a severe storm of wind, rain, and hail, accompanied by lightning and thunder, visited this section at 8.15 p. m. The storm gathered south of the city and traveled north and west about four miles, thence north and east. About fourteen barns, five houses, one church, one school house, and a large number of out-buildings were destroyed, the debris being scattered over the prairie for miles. Washington, Washington Co.: the storm which passed over Hollenberg, this county, in the evening, demolished the Methodist church and the Grand Army Republic hall; unroofed the grain elevator, and scattered the contents of the lumber yard over the prairie.—*Hutchinson (Kansas) Daily News, May 8.* **Dakota.**—Yankton: a violent thunder-storm from the southwest began 9.35 p. m., and continued into the night. Maximum velocity of wind, fifty-six miles per hour from the south at 10.05 p. m.; an unfinished building was blown down.

7th. Minnesota.—Saint Cloud, Stearns Co.: a terrible wind storm has been raging here since last evening. No great damage has been done in this town, but reports from the surrounding country state that a number of houses and barns have been unroofed or moved from their foundations.—*The Republic, Mexico, Mo., May 27th.* **Wisconsin.**—Green Bay: during the thunder-storm which prevailed between 5.05 p. m. and 5.18 p. m. a ball of fire jumped from the telephone wire, rolled along the street fifteen or twenty feet, throwing off brilliant sparks in every direction and then exploded with a report like that of a cannon and emitted clouds of smoke. At the telephone office a ball of fire came in over the wire, setting fire to the back of the switchboard and severely shocking one of the operators.

9th. Iowa.—Marshalltown, Marshall Co.: the worst hail-storm of years, accompanied by excessive rainfall, occurred during the day. Hundreds of windows were shattered, trees stripped of their foliage, fruit and vegetation seriously damaged, and fields badly washed out. The hail lay in drifts for two or three hours.—*Des Moines, Iowa, State Register, May 11.*

10th. Illinois.—Belvidere, Boone Co.: a most terrific hail, wind, and rain storm visited this city and vicinity in the afternoon. Hail-stones as large as walnuts fell for thirty minutes. The fruit trees are all in full bloom, and much damage will be done to cherries and late apples. Much of the planted corn will probably have to be replanted, the seed being literally washed out of the ground. The florists will be the worst sufferers, hundreds of lights of glass being broken and

plants cut to pieces. Unprotected stock in the open fields suffered seriously.—*The (Nashville, Tenn.) Herald, May 11.* Aledo, Mercer Co.: a heavy storm swept through this county at 5 p. m., doing considerable damage. Trees and fences were blown down and several houses and barns demolished.—*New York Daily Tribune, May 12.* Chicago: a thunder-storm, accompanied by vivid lightning, and moving from northwest to southeast, began 5.36 p. m. and ended 11 p. m. Rain commenced 6.05 p. m. and fell in torrents for a few minutes, then changed to hail, which fell very rapidly and covered the ground to a depth of one-half inch; some of the hail-stones measuring over one inch in diameter. *Iowa.*—Des Moines: a severe storm began 3.35 p. m. and ended 4.12 p. m. Maximum velocity of the wind forty-six miles per hour at 4.08 p. m. A number of houses and barns in this city were unroofed or otherwise damaged. *Pennsylvania.*—Hop Bottom, Susquehanna Co.: a thunder-storm, accompanied by very heavy rain, high wind, and some hail passed over this place between 2.45 p. m. and 3.15 p. m. The air was so dark during the storm that the clouds could not be seen, and the wind whirled in all directions. A number of buildings were demolished by the storm.—*Report of E. M. Tiffany. Michigan.*—Port Huron: at 9.30 a. m. the wind suddenly veered to northwest and increased in force, attaining a velocity of thirty-six miles per hour at 9.55 a. m. The storm ended 10.05 a. m. The schooner "Mary Hattie," which was about to enter the Saint Clair river, was driven ashore. *New York.*—Albany: a storm, moving from wnw. to ese. prevailed from 5.16 p. m. to 6.40 p. m. The storm was very violent for a few minutes, and trees, fences, and awnings were blown down.

10-11th. Illinois.—Geneva, Kane Co.: a heavy wind, accompanied by tremendous rainfall, passed over this section during the night. Hundreds of trees were blown down and many orchards ruined. It was the heaviest wind known here for years, and has ruined the prospect for a promising fruit crop.—*New York Daily Tribune, May 12.* *Pennsylvania.*—Pittsburgh: reports of damage from storm during the night of the 10-11th are coming in from all parts of Allegheny county, in fact from nearly every place in eastern Ohio and western Pennsylvania. Farms were washed out, houses, fences, and trees along the banks of streams were swept away, and landslides occurred on nearly every road leading from Pittsburgh. So far four deaths from drowning have been reported.—*New York Daily Tribune, May 12.*

11th. Indiana.—Indianapolis: reports show that dangerous storms swept over the southwestern portion of the state this afternoon; many buildings were demolished, and telegraph and telephone wires suffered badly.—*The (Nashville, Tenn.) Herald, May 12.* *Kentucky.*—Paducah, McCracken Co.: a terrific storm raged here this afternoon; many buildings were unroofed. The spire of the Methodist church was blown down, crushing the roof and wrecking the building.—*The (Nashville, Tenn.) Herald, May 12.*

12th. Texas.—Brady, McCulloch Co.: a very severe wind and hail storm passed through Conejo and Menard counties, killing a number of sheep and calves, and putting out the eyes of several horses. When the storm crossed over Brady Creek it killed hundreds of fish, from large sized catfish down. The destructive path of the storm was about three-fourths of a mile wide.—*Report of W. H. Potter to the Texas State Weather Service.* La Grange, Fayette Co.: a very severe wind and rain storm, accompanied by hail, occurred on this date. The storm was very destructive to corn and cotton crops, which will require replanting in many places. Trees were uprooted, fences blown down, and telegraph poles prostrated. A land slide occurred on the Missouri Pacific railway, four miles north of this place, which delayed trains five hours. The path of the storm was very narrow, which fact was shown by its effect on vegetation.—*Report of Joseph Cottam to the Texas State Weather Service.* *Kentucky.*—Hopkinsville, Christian Co.: one of the most violent and destructive rain and hail storms ever known in this section passed over the southern portion of this county

late in the afternoon. At Longview and Bennettstown lumps of hail as large as goose eggs were picked up, and pieces of ice six inches long were seen. Crops suffered seriously. Tobacco plants were cut down, and fruit trees stripped of their leaves and blossoms. The heaviest loss was to wheat. It is estimated that 600 acres were entirely destroyed and as much more seriously damaged. Estimated loss, \$6,000 to \$10,000.—*The (Nashville, Tenn.) Daily American, 14.* *Virginia.*—Harrisonburg, Rockingham Co.: a terrific storm passed over this county on this date. Lightning destroyed several barns and stables. Much stock was killed. A part of the county was visited by a severe hail storm which utterly destroyed the wheat crop, and fences and houses were blown down.—*New Haven (Conn.) News, May 14.* Dale Enterprise: a series of heavy thunder-storms passed over this place during the day, and one of a very destructive nature occurred at 5.30 p. m. The wind blew down fencing and timber, and a large dwelling house in course of construction was completely wrecked. Hail fell to a depth of one inch and remained on the ground for several hours after the storm had passed. All vegetation was completely riddled by the falling hail-stones. Within the space of fifteen minutes 1.10 inch of rain fell; the water rushed down the hillsides in torrents. Fencing was swept away by the flood in places where floods were never known to occur before. The path of the storm was about one mile wide. Depth of rainfall, within fourteen hours, 2.44 inches.—*Report of voluntary observer.*

13th. Washington Territory.—Tacoma: a destructive storm set in suddenly from the southwest at 5.50 p. m. A building in course of erection was demolished, burying the working-men in the ruins; four men were killed and several severely injured. A new building in the southern part of the city was also wrecked by the wind. *The (Portland, Oregon,) Oregonian, May 14.* *Kentucky.*—Louisville: a severe hail-storm is reported to have occurred in the suburbs of this city during the afternoon and evening. Reports also show that hail-storms occurred throughout the state during the day, and that crops in many sections suffered serious damage from them. Lair, Harrison Co.: a hail-storm of but a few minutes duration occurred about two miles south of this place at 3 p. m. The stones were unusually large and fell in sufficient quantity to cover the ground, knocking down horses and injuring stock and crops seriously; limbs of trees from one to one-and-one-half inch in diameter were broken off by the hail.—*Report of O. L. Ballinger.* *Georgia.*—Grantville, Coweta Co.: This community was visited during the day by a severe wind, rain, and hail storm, doing considerable damage to growing crops. Corn and cotton are badly injured, while gardens are almost ruined.—*The (Savannah, Ga.) Morning News, May 16.* *Massachusetts.*—Vineyard Haven: a severe thunder-storm passed over this place between 8.20 and 10.10 p. m., moving from southwest to northeast. Several houses were struck by lightning, and telegraph lines were prostrated.

14th. Virginia.—Danville, Pittsylvania Co.: the severest storm ever known in this city occurred in the afternoon, doing much damage to houses, fences, fruit trees, etc.; estimated damage, \$3,000. The storm was accompanied by rain and slight hail, and lasted about fifteen minutes.—*The Daily Virginian, May 15.* Norfolk: a violent thunder-storm, attended by rain, hail, and high wind, and passing from southwest to northeast, occurred between 2.50 and 4.30 p. m. The wind, which attained a maximum velocity of forty-eight miles per hour, demolished out-buildings and uprooted trees. Truck gardens in this vicinity suffered much damage from the hail. *North Carolina.*—Kitty Hawk: at 8 p. m. the wind shifted suddenly from southwest to northwest, with a velocity of forty-five miles per hour for ten minutes, and accompanied by light rain. A violent hail-storm is reported seven to nine miles north of this place, breaking a large number of window-panes in residences. Several trees were blown down and fences damaged. Six iron poles on the coast line, in the track of the storm, were broken off, as was also the wire. *Wilmington:*

reports from Magnolia, Duplin Co., and from Lumberton, Robeson Co., state that a severe hail-storm passed over those places between 4 and 5 p. m. The storm approached from the west, and was accompanied by terrific west to north-west winds. Large hail-stones fell to a depth of from one to three inches. At Lumberton two houses were blown down and one unroofed. Most of the cotton crop in the sections visited by the storm will have to be replanted, as it is almost a total loss.

14-15th. Nebraska.—Omaha: the rain which began at 10 p. m., 14th, came down in torrents shortly after midnight and did considerable damage by flooding streets and overcrowding the capacity of sewers.—*Omaha (Nebr.) Bee, May 15.*

15th. Iowa.—Burlington, Des Moines Co.: a heavy rain-storm struck this city in the morning, and continued two hours. A wind-storm followed which unroofed two business houses, while barns and other buildings were moved from their foundations, and trees and fences blown down. The aggregate damage is considerable, though the individual losses are not heavy.—*Evening Herald, Duluth, Minn., May 16.*

16th. Iowa.—A severe storm passed over Iowa during the night. At Waterloo and Cedar Falls the rain came down in torrents, so that in many places the water rushed over the tracks at such a rate that the north bound train was held for over an hour. On the Milwaukee road lightning struck and fired the depot at Volga City. Several bridges on the Turkey Creek branch were washed away. At Cedar Rapids, this morning, it took the form of a hail-storm; hail as large as hens' eggs fell, causing considerable damage to skylights, greenhouses, etc.—*The (Cedar Rapids, Iowa,) Daily Gazette, May 16.* **Arkansas.**—Hot Springs: a report from Buckville, Montgomery Co., states that the severest hail-storm known for years visited that section during the day. The hail-stones were of unusual size and fell with terrific force, damaging the crops, and in many places crushing through the tops of houses. The fruit crop is damaged 50 per cent.—*Galveston News, 18.*

17th. Kansas.—Abilene, Dickinson Co.: the severest storm in the history of the city raged here last night. The lower part of the city was completely flooded, and several houses have their cellars full of water. Thousands of dollars of damage has been done. Considerable hail fell during the storm.—*Galveston News, May 18.* Leavenworth: a severe thunder-storm, passing from west and northwest to east and southeast, began shortly after midnight and continued until 4.35 p. m. The storm was accompanied by heavy rain from 12.55 a. m. to 11.40 p. m., causing delay of trains from two to four hours on all railroads leading to this city. **Texas.**—Gainsville, Cook Co.: one of the most disastrous storms that ever visited this section occurred in the afternoon and evening at Mossville, this county. A number of houses were blown down, but no persons were injured. At Erle, this county, great damage was done to houses, and all through the western portion of the county the growing crops were badly injured. Wylie, Collin Co.: considerable rain and hail fell during the day, doing much damage to growing crops in this section.—*Galveston News, May 19.* **Wisconsin.**—Milwaukee: a severe thunder-storm, accompanied by excessive precipitation and vivid lightning passed over this city in the afternoon. Several buildings were struck by lightning. Three men were drowned while working in an underground sewer; the dam erected at the head of the excavation gave way and the force of the water was so great as to render escape impossible. **Missouri.**—Kansas City: a thunder-storm moving from northwest to southeast occurred in the afternoon. Rain, which began at 9.30 a. m., continued throughout the day, and was very excessive between 2 p. m. and 5 p. m., causing great damage in low-lying districts in the southeastern and western portions of this city, and in adjoining Kansas City, Kans. In a number of houses the cellars and lower floors are flooded, and many buildings in course of construction were injured by the settling of foundations, etc. A number of railroad tracks are under water and some of them have been buried under heavy land-slides, delaying trains from

nine to twenty-four hours. A number of the cable railways are also greatly delayed and damaged by the flooding of the engine-rooms. A rough estimate places the damage at \$50,000.

18th. Texas.—Corpus Christi: a thunder-storm, accompanied by heavy rain, began during the night and ended 8.10 a. m. Maximum velocity of wind forty-seven miles per hour from the northeast at 7.57 a. m. All communication on the Western Union telegraph lines northward was cut off.

19th. Kansas.—Topeka: a thunder-storm, accompanied by heavy rain, passed over this city in the evening. The wind attained a maximum velocity of thirty-two miles per hour at 8 p. m. Several houses in course of erection in the western portion of the city were demolished, and one church steeple was blown down. **Pennsylvania.**—Oil City, Venango Co.: a heavy rain-storm, accompanied by thunder and lightning, passed over this place at 1.30 a. m. An oil well near Norway, Chester Co., with a tank full of oil, was ignited by lightning and destroyed, and at Rouseville, Venango Co., a church was struck by lightning and burned to the ground.—*New York Daily Tribune, May 20.* **Ohio.**—Tiffin, Seneca Co.: a storm passed over the southwestern part of this county last night. The wind blew a gale and at Berwick many houses and barns were unroofed, and many miles of fencing blown down. Near Bascomb a large number of buildings were damaged. The rain fell in torrents, accompanied by hail, and the crops were injured considerably. The damage will run up into thousands of dollars.—*New York Daily Tribune, May 20.*

20th. Pennsylvania.—Scranton, Lackawanna Co.: the stretch of farming country from Clark's Summit, on the Delaware, Lackawanna, and Western railroad, east to and beyond the neighboring village of Clark's Green, seven miles north of Scranton, was devastated by a storm this afternoon that left wreckage and destruction all along its path. The fury of the storm, accompanied by a deluge of rain, began shortly after noon and lasted about half an hour. Several buildings were demolished, and every orchard in the path of the storm was wrecked, trees being torn up by the roots and carried many yards. The storm was the most destructive that has ever occurred in northeastern Pennsylvania.—*Commercial Gazette, Pittsburgh, Pa., May 21.* **Tennessee.**—Nashville: a severe gale, accompanied by light rain and thunder, passed over this city between 5.30 and 6 p. m., causing considerable damage by prostrating trees, fences, etc. In the outskirts of the city a church was completely wrecked.

20th-21st. New York.—Troy, Rensselaer Co.: the most disastrous storm and freshet for many years occurred here during these dates. The Champlain canal overflowed and the crops in the lowlands were ruined. At Comstock's, Washington Co., four inches of rain fell during these days, causing serious damage to crops. A furious storm of wind, rain, and hail occurred at Sandy Hill, same county, causing considerable damage to crops.—*Evening Wisconsin, Milwaukee, May 22.*

22d. West Virginia.—Wheeling, Harrison Co., was visited this day by a terrific hail-storm which did great damage to crops. In the city hail lay on the ground three to five inches deep. The loss to farmers will be very heavy. *The (La Crosse, Wis.) Chronicle, May 23.*

23d. Missouri.—Kansas City: a thunder-storm, passing from west to east, and attended by vivid lightning, loud thunder, and unusually large hail, with heavy rain, occurred between 6.25 p. m. and 9.45 p. m. Hail fell for ten minutes, some of the hail-stones measuring two inches in diameter, breaking thousands of panes of glass, and causing much damage to houses and plants in the eastern and southern sections of the city. The hail-belt is reported to have been about two miles wide and to extend eastward about thirty miles. All outgoing trains from the city were delayed, and a washout was caused by the extraordinarily heavy rain on the Union Pacific railroad, about seventeen miles west of this city.

25th. Tennessee.—Knoxville: a thunder-storm from the west began 2.40 p. m. and ended 2.58 p. m., when rain and hail began, a precipitation of 0.50 inch occurring in ten minutes.

The hail-stones measured from one-quarter to one-half inch in diameter. The wind, which blew at the rate of twenty-eight miles per hour for five minutes, attained, during a gust, a velocity of forty miles per hour. Another storm from the west prevailed between 5.45 p. m. and 7 p. m.; maximum velocity of the wind, thirty-six miles per hour, at 6.05 p. m. Several cellars in the city were flooded by the heavy rain.

27-28th. New York.—Albany: one of the most severe gales of the season began at 6.54 p. m., 27th, and continued until 4.36 p. m. the following day; maximum velocity of wind, fifty-four miles per hour, at 2.10 a. m., 28th. Considerable damage was done to the outer breakwater by the wind and high sea; the inner breakwater was completely submerged. Trees, signs, etc., suffered from the gale. Navigation was entirely suspended during the early part of the 28th.

29-30th. Michigan.—Detroit: a heavy rain began 9.50 a. m., 29th, and continued steadily during the night and following day. A gale set in 7.18 a. m., 30th, and ended 8.51 p. m., same day; maximum velocity of the wind, thirty-two miles per hour from the northeast, at 3 p. m. The heavy rain caused considerable damage to buildings in course of erection, and several squares of the cedar paving was loosened and rendered useless. The traffic in the streets was seriously impeded and business generally suspended. Reports from all over the state show that the heavy rain during these days caused great damage to crops.

30th. Kansas.—Topeka: a storm began at 4.45 p. m. in the eastern part of Marion county, and travelled due east until within two miles of Clements, Chase Co., thence it passed

alternately southeast and northeast until it reached a high bluff about three miles from Clements, where it was dissipated. Time of passage forty-five minutes. The storm demolished several buildings, trees, and fences in its path. One man was killed and several seriously injured. **North Carolina.**—Charlotte: high wind began 11.30 a. m., and continued until 6.15 p. m., from the southeast and south; maximum velocity, thirty-four miles per hour from the southeast. Heavy rain began about noon and continued at intervals throughout the day, at times very heavy. Many fruit trees were blown down and other minor damage done in this city. A large tobacco warehouse was blown down at Danville, near this city; five persons were killed and several seriously wounded. Small grain, which was ready for harvesting, was considerably injured by the heavy rain and high wind. **Wisconsin.**—Milwaukee: a gale from the northeast began 8.15 a. m., 30th, and ended 2.15 a. m., 31st; maximum velocity of the wind forty-two miles from the northeast at 12.05 p. m., 30th. It is reported that the storm was very severe on Lake Michigan; a large number of vessels having sprung a leak, lost deck loads, and suffered other minor mishaps.

30th-31st. South Carolina.—Charleston: brisk to high southerly winds prevailed all day, 30th, and continued until the early part of the following day; maximum velocity of the wind thirty-six miles per hour from the south at 5.40 p. m., 30th. A similar velocity from the southeast was also recorded at 3.40 a. m., 31st. The steamer "Pilot Boy," and the pilot boat "Charleston," were blown ashore during the gale; they sustained but slight injury.

INLAND NAVIGATION.

STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the various stations; the highest and lowest water for May, 1889, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, May, 1889 (in feet and tenths)

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.	29.9	1.	17.9	29	10.9	7.0
<i>Arkansas River:</i>						
Fort Smith, Ark.	22.0	23	14.0	14	3.8	10.2
Little Rock, Ark.	23.0	26	15.4	16, 17	6.0	9.4
<i>Missouri River:</i>						
Port Buford, Dak.	.....	31	6.4	15	2.3	4.1
Omaha, Nebr.	18.0	1, 31	7.1	13, 14	6.4	0.7
Lawrence, Kan.	20.0	28, 29, 30	9.2	5, 6	7.0	2.2
Kansas City, Mo.	21.0	29, 30	10.6	6	7.2	3.4
<i>Mississippi River:</i>						
Saint Paul, Minn.	14.5	21	4.5	15	3.2	1.3
La Crosse, Wis.	24.0	26, 27	6.6	1	4.6	2.0
Dubuque, Iowa	16.0	30	7.4	1	4.8	2.6
Davenport, Iowa	15.0	31	5.1	1, 2, 3, 4	3.2	1.9
Kokomo, Ind.	14.0	21, 22, 24	6.2	6, 7	3.0	3.2
Saint Louis, Mo.	32.0	31	24.1	9, 12	7.8	16.3
Cairo, Ill.	40.0	26	20.8	19	12.7	8.1
Memphis, Tenn.	34.0	1	16.3	21, 22	10.0	6.3
Vicksburg, Miss.	41.0	2	26.1	26	13.1	13.0
New Orleans, La.	13.0	5	9.1	25, 26, 28	4.3	4.8
<i>Ohio River:</i>						
Pittsburgh, Pa.	22.0	1	10.8	10	3.7	7.1
Parkersburg, W. Va.	35.0	2	14.0	23, 23	5.8	8.2
Cincinnati, Ohio	50.0	6	24.0	27	10.8	13.2
Louisville, Ky.	25.0	7	9.4	28	5.8	3.6
<i>Emberland River:</i>						
Nashville, Tenn.	40.0	1, 2	6.8	25, 26, 29	3.4	3.4
<i>Tennessee River:</i>						
Chattanooga, Tenn.	33.0	7	5.0	26, 27, 28	2.7	2.3
<i>Mongahela River:</i>						
Pittsburgh, Pa.	29.0	1	10.8	10	3.7	7.1
<i>Savannah River:</i>						
Augusta, Ga.	32.0	31	9.8	30	6.8	3.0
<i>Willamette River:</i>						
Portland, Oregon	15.0	21	10.0	3, 4	5.2	4.8

*13 days missing.

Mississippi River.—Vicksburg, Miss., 26th: this morning the stage of water in the river, 13.1 feet above low-water mark, is the lowest reading in May since the opening of the Signal Service Station in 1872.—*Report of Signal Service observer.*

Erie Canal.—Rochester, N. Y.: the canal was opened to navigation for the season on the 1st.

FLOODS.

A report, collated from all available data, of the disastrous floods of May 30th, 31st, and June 1st, in districts of the Middle Atlantic states and upper Ohio valley, is published in this issue of the REVIEW. The following reports refer to floods noted during the month in other sections of the country:

Kansas City, Mo.: at 3.30 a. m., 19th, two spans, each 120 feet long, of the National Waterworks Company's bridge, over the Kaw River, upon which the thirty-six-inch water main that supplies the city with water is supported, was washed away by the pressure of the high water and the jamming of driftwood. Damage estimated at \$20,000.

Chillicothe, Livingston Co., Mo., 21st: the Grand River, near this place, is greatly swollen, and the bottoms are flooded. Great damage and some loss of life is reported. All the ferry-boats have been washed away, and the bridges cannot be approached.—*Union Advertiser, Rochester, N. Y., May 21st.*

Littleton, Grafton Co., N. H., 22d: the heavy rains of the past two nights caused the upper reservoir of the Littleton Water and Electric Light Company to burst last night. The reservoir covered about eight acres, and the great body of water came down Palmer brook, gullying it into a large river bed, uprooting trees, and piling up debris. Two bridges and one barn were demolished, a dwelling seriously damaged, and the fields along the brook were flooded.—*Rochester, N. Y., Herald, May 23d.*

Albany, N. Y., 24th: the recent rains have caused the creeks along the Delaware and Hudson railroad to overflow and flood the lands from Smith's Basin, Washington Co., to Whitehall, same county. Considerable damage has been done to crops. Business on the Champlain canal has been suspended on account of the high water in the canal.—*New London, Conn., Telegraph, May 25.*

Topeka, Kans., 27th: the fields on the north side of Kansas River, between this place and Kansas City, are about one-third under water from the heavy rain in that section on the 23d. Houses and barns were observed standing on minia-

ture islands, wagon roads were under water, with nothing to indicate the roadway except the tops of fences on either side.

Chattanooga, Tenn.: rain began 2.37 a. m. and ended 9.35 a. m., 30th, falling at times very heavily; 2.55 inches fell in less than seven hours. The sewers were inadequate to carry

off the water, and the city was flooded in various places to a depth of from one to twenty-three inches.

HIGH TIDES.

Baltimore, Md.: considerable damage resulted from the high tide along the water front on the 31st. Many of the wharves were submerged by water during the day.

ATMOSPHERIC ELECTRICITY.

AURORAS.

On the Atlantic coast auroras were reported as far south as Egg Harbor City, N. J. West of the Atlantic coast auroras were not reported south of the fortieth parallel. The most notable displays occurred on the 21st, when they were observed in New Hampshire, Iowa, and Minnesota.

The following reports have been made of the more important displays noted:

Duluth, Minn.: an aurora was observed from 10.35 p. m. 21st to 1.20 a. m. 22d. It extended from about 160° to 200° azimuth, and to about 25° altitude. The display was very faint and consisted simply of a pale whitish light.

Saint Vincent, Minn.: an aurora consisting of a confused mass of light, which rose to altitude 12° , and extended from azimuth 145° to 220° , was observed from 11 p. m. 21st to 12.20 a. m. 22d.

Eastport, Me.: a faint auroral arch which rose to altitude 17° , and covered 90° of the horizon, from within a few degrees of east-northeast to northwest, was observed from 8.45 to 10.30 p. m. 26th.

Auroras were observed during the month as follows: 3d, Peking, Ill.; Cresco, Iowa. 5th, West Milan, N. H. 10th, Royalston, Mass. 13th, Grantsburgh, Wis. 18th, South Canistee, N. Y. 21st, Dysart, Iowa; Duluth and Saint Vincent, Minn.; Nashua, N. H. 23d, South Canistee, N. Y. 25th, Tatoosh Island, Wash. 26th, Eastport and Mayfield, Me.; Royalston, Mass. 27th, South Canistee, N. Y. 28th, Bev-

erly, N. J. 30th, Egg Harbor City, N. J.; South Canistee, N. Y. 31st, Dysart, Iowa.

THUNDER-STORMS.

The more severe thunder-storms are described under "Local storms." Thunder-storms were reported in the greatest number of states and territories, twenty-seven, on the 13th; in twenty-six on the 10th and 29th; in twenty-four on the 14th, 20th, and 27th; in twenty-two on the 21st, 25th, and 30th; in twenty-one on the 26th; in from fifteen to twenty, inclusive, on the 11th, 12th, 17th to 20th, 22d to 24th, and 28th; in from ten to fourteen, inclusive, on the 1st, 7th, 9th, 15th, 16th, and 31st; in from five to nine, inclusive, on the 2d to 6th, and 8th. There were no dates for which thunder-storms were not reported in one or more states or territories.

Thunder-storms were reported on the greatest number of dates, twenty-nine, in Kansas; on twenty-one in Illinois; on twenty in Iowa and Michigan; on from fifteen to nineteen, inclusive, in Minnesota, Missouri, North Carolina, Ohio, Pennsylvania, and Texas; on from ten to fourteen, inclusive, in Alabama, California, Dakota, District of Columbia, Indiana, Indian Ter., Louisiana, Maryland, Massachusetts, Nebraska, New York, South Carolina, Tennessee, Virginia, and Wisconsin; on from five to nine, inclusive, in Arkansas, Colorado, Florida, Georgia, Kentucky, Mississippi, Montana, Nevada, New Jersey, Oregon, Washington, West Virginia, and Vermont. There were no states or territories in which thunder-storms were not reported for one or more dates.

MISCELLANEOUS PHENOMENA.

PRAIRIE FIRES.

Prairie fires were reported during the month as follows: New England City, Dak., and Saint Vincent, Minn., 3d; Saint Cloud, Minn., 7th; Fort Sill, Ind. T., 11th.

FOREST FIRES.

Duluth, Minn., 7th: destructive forest fires are still raging in all directions, but in many localities they have burned themselves out. They have attacked the heavy pine woods in many places, and the loss of timber will be very large. Several hundred thousand ties, and thousands of cords of wood have been burned. Numerous buildings, hay, meadows, crops, and bridges have been burned in the western part of the county. Farmers and mill men in the country are fighting the fires. The air in the city is filled with smoke.—*Chicago, Ill., Tribune*, May 7.

La Crosse, Wis.: extensive forest fires prevailed in the northern part of the state on the 4th, 5th, and 6th, and owing to the dry weather the fires burned fiercely. Railroad men arriving over the Omaha road on the 4th report that the forest from Ashland to Clear Lake, one hundred and fifty miles, is ablaze. Many thousands of ties have been destroyed and some towns endangered. On the Fond du Lac Indian reservation \$50,000 worth of logs and skids were burned. The heavy rain which fell on the 7th in the northern section of the state, partially extinguished the fires.

Mason City, Cerro Gordo Co., Iowa, 8th: destructive fires have been burning in the woods between Plymouth and Rock Falls, this county, since the evening of the 4th. So far the

farmers have been able to save their homes.—*Union and Advertiser, Rochester, N. Y.*, May 8.

Newburgh, Orange Co., N. Y., 8th: forest fires are burning in the Shawangunk Mountains and in the Catskills; also in the highlands below this city, and on the Fishkill Mountains. Passengers on the New York and New England road state that the fires are burning on the mountains in that vicinity and on the state line. A large amount of wood land has been seriously damaged. The fires are reported to be on the increase in all directions.—*Democrat and Chronicle, Rochester, N. Y.*, May 9.

Michigan: reports from various points in the upper peninsula show that severe forest fires have been in progress in that section since about the 5th; fences, cord wood, shingles, posts, and standing timber have been consumed. It is estimated that half a million feet of logs have been burned, the crops ruined in many localities, and a large number of buildings destroyed. Reports also show that destructive fires were general at about the same time in the northern portion of the state, and in Ottawa, Muskegon, Midland, Clare, Gladwin, and Osceola counties, in the middle portion; in Lenawee county, in the southeastern, and Allegan county in the southwestern portion of the state. The light rain in the upper peninsula on the 8th, and in the southern half of the state on the 10th, and the general rain throughout the state from the 15th to the 22d extinguished the fires.

Custer City, McKean Co., Pa., 8th: a fierce forest fire has been raging about the Moody tract, five miles south of this place, all day. The tract is one of the most valuable oil properties in this county, and a large number of rigs and small

tanks of oil are reported destroyed. A big forest fire is in progress in the lumber woods near Kane, this county, and is working its way rapidly towards Porter station. There are fires on all sides of here, and another large one is plainly seen to the northwest.—*Chicago, Ill., Tribune, May 9.*

Alachua, Alachua Co., Fla., 31st: the forest fire which has been raging in this section has done considerable damage to fences.—*The (Savannah, Ga.) Morning News, June 2.*

Forest fires were also reported as follows: Fort Apache, Ariz., 6th, 12th, 18th, 24th, 31st; Green Bay, Wis., 6th.

HALOS.

Solar halos were most frequently reported in Michigan, where they were noted on twenty-two days; in New York on twenty days; in Ohio on seventeen days; in California, Illinois, Nevada, Tennessee, and Washington Territory on from ten to fifteen days; in Dakota, Indiana, Iowa, Kansas, Massachusetts, Minnesota, Oregon, Pennsylvania, South Carolina, Texas, and Wisconsin on from five to nine days; in Arizona, Arkansas, Florida, Georgia, Idaho, Indian Territory, Kentucky, Maine, Maryland, Mississippi, Missouri, Montana, Nebraska, North Carolina, Utah, Virginia, and Vermont on from one to four days. In states and territories other than those named no solar halos were reported. They were noted in the greatest number of states and territories, sixteen, on the 1st; in fourteen on the 30th; in twelve on the 22d; in eleven on the 25th; in from five to ten on the 3d to 9th, 11th to 20th, 23d, 24th, 26th to 29th, and 31st. There were no days for which solar halos were not reported in one or more states or territories.

Oswego, N. Y.: a partial solar halo of 22° radius was observed at 8 a. m.; it became complete about 8.45 a. m., and was visible until 2.40 p. m. At 9.15 a. m. an elongated ellipse, covering about 92° of the horizon, appeared; the southern half mostly within the lower half of the halo, its upper edge directly over the sun. At this time a contact arch was observed below, and another arch below and to the left of the halo; an arch of greater diameter and altitude was also seen in the west. The circle and arches showed a fair amount of color, while the ellipse was faint. At 9.30 a. m. the halo was double on its north and south sides, and the ellipse at its northern extremity; the contact arch had disappeared. The display was brightest and best defined at 9.25 a. m., the ellipse becoming brilliant and well defined.

Lunar halos were most frequently reported in Ohio, where they were noted on twelve dates; in Illinois, Indiana, Iowa, Louisiana, Missouri, Tennessee, and Virginia on from five to ten dates; in Alabama, California, Colorado, Dakota, Florida, Georgia, Idaho, Kansas, Kentucky, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Montana, Nebraska, Nevada, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Texas, and Wisconsin on from one to four dates. In states and territories other than those named no lunar halos were reported. They were reported in the greatest number of states and territories, fourteen, on the 9th; in thirteen on the 10th and 11th; in twelve on the 7th and 12th; in from five to ten on the 5th, 6th, 8th, 13th, and 14th; in from one to four on the 3d, 4th, 15th to 17th, 20th, 27th, 29th, and 30th. For dates other than those given no lunar halos were reported.

METEORS.

The distribution of meteors, by dates, was as follows: 1st, Villa City, Fla.; 3d, Whipple Barracks, Ariz.; 7th, Nashville, Tenn.; 9th, Saint Louis, Mo.; 11th, Wheeling, W. Va.; 12th, Wedgewood, N. Y., Jefferson, Ohio; 17th, Whipple Barracks, Ariz.; 18th, Villa City, Fla., Nashua, N. H.; 22d, Auburn, Ala.; 23d, Point Peter, Ga., East Portland, Oregon; 24th, Auburn, Ala., Yellow Springs, Ohio; 25th, Kissimmee, Fla.; 26th, Villa City, Fla.; 31st, Fort Smith, Ark.

The following are descriptions of the more notable meteoric displays reported: Whipple Barracks, Ariz., 3d: two meteors were observed in the evening. The first was clear and distinct; was seen at altitude 70° and azimuth 105° ; traveled

about 20° in a northwesterly direction and disappeared. The second was observed at midnight in about altitude 60° , and azimuth 75° , and passed about 25° in a northerly direction. This meteor was very brilliant and left an illuminated path which was visible for about five seconds.

Saint Louis, Mo.: a meteor of large size is reported to have passed across the sky from northwest to southeast at 5.25 p. m., 9th. The meteor left a crimson light in its path for about half of its passage.

Wheeling, W. Va.: a large meteor fell near Addison, Webster Co., on the 11th. It was about five feet in diameter, and was first seen over the mountain north of the village. It passed through the air in a semi-circle, with a loud whizzing sound, and buried itself in the ground near Cogar's Mill, the fall jarring the earth for a radius of two or three miles. It had the appearance of a ball of fire, lighting up the sky for miles around.—*The (Nashville, Tenn.) Examiner.*

Auburn, Lee Co., Ala.: during the month two large meteors were observed. One was observed at 10 p. m., 22d. It appeared at an altitude of about 80° , and moved from northeast to south. The meteor was accompanied by a hissing noise, which became louder, and finally ended in an explosion, bursting into several pieces. The other one was observed at 7.55 p. m., 24th, in about altitude 70° and moved in a north-easterly direction.—*Report by A. St. C. Dunstan to the Alabama State Weather Service.*

Fort Smith, Ark., 31st: a brilliant meteor passed across the sky from northeast to southwest and exploded when about 30° above the southwestern horizon. Its path was indicated by a sheen of white light which lasted several seconds after the passage of the meteor.

MIRAGE.

San Diego, Cal., 29th: a mirage was observed in the southwest at 1 p. m. The Coronado Hotel and grounds and the Point Loma light-house and out-buildings were plainly seen.

Palmyra, Wayne Co., N. Y., 1st: a distinct mirage was observed off Lake Ontario at 10 a. m. but faded rapidly away. It was again seen at 2.30 p. m. and remained visible for about thirty minutes. The shores of Canada could be seen with the naked eye, and with a glass a vessel and white-cap waves could be plainly distinguished.—*Democrat and Chronicle, Rochester, N. Y., May 2.*

Mirage were observed at Webster, Dak., on the 1st, 2d, 3d, 9th, 10th, 13th, 21st, 23d, 27th to 30th.

SAND STORMS.

Salt Lake City, Utah: a sand storm, the severest experienced here for years, occurred the afternoon of the 5th. The wind attained a maximum velocity of thirty-six miles per hour and the sand in the atmosphere was, at times, so dense that objects across the street could not be distinguished.

Harrisburg, Pa., 10th: a terrific wind and sand storm began 4.10 p. m. and lasted about twenty minutes, the sand and dust being so thick that they obstructed the view across the street. Sand storms were also reported as follows: Fresno, Cal., 2d, 5th, 14th; San Carlos, Ariz., 5th to 8th, 14th, 15th; Concordia, Kans., 6th; Wilcox, Ariz., 7th, 8th, 15th, 16th, 22d, 23d, 24th; Yuma, Ariz., 8th, 15th, 16th; Holbrook, Ariz., 15th.

DROUGHT.

Protracted droughts, resulting in serious damage to crops, were reported in sections of the Southern States.

Salt Lake City, Utah: southward from Utah county the country never looked drier than at the present time. In the south end of San Pete Valley the stream from which Gunnison receives its water supply is nearly invisible, the channel being dry under the bridge at that town. In Sevier Valley the situation is the same.—*Salt Lake, Utah, Evening News, May 3.*

The drought which was becoming severe in the southern half of Michigan was broken on the 10th by light, well-distributed showers.—*Report of the Michigan State Weather Service.*

Key West, Fla., 13th: since April 4th there has been no

material rainfall in this section, and the want of drinking water is beginning to be felt.

Fernandina, Nassau Co., Fla.: nearly a month has passed since any rain fell at this place. The growing crops have been damaged, the cisterns are dry, and the shade trees are drooping.—*The (Savannah, Ga.) Morning News, May 20.*

Wainright, Charlton Co., Ga., 24th: the drought is having a damaging effect upon the growing crops. Gardens are ruined and vegetation in some places is parched and dry.—*The (Savannah, Ga.) Morning News, May 25.*

Memphis, Tenn.: the drought which has prevailed in this section since the 1st of the month was broken on the 25th.

Convent, Saint James Parish, La.: no rain fell from the 1st to the 28th, when a storm occurred in the lower half of the parish. The dry weather and the low stage of the Mississippi River have proved very unfavorable, especially to the rice crop, over six thousand acres of which have been abandoned.—*Report of Prof. F. Greene to the Louisiana State Weather Service.*

Hammock, Alachua Co., Fla., 29th: owing to a scarcity of rain there is a heavy loss in the vegetable crop. Sixty-five per cent. will not more than cover the damage. It is about seven weeks since rain fell. The drought has caused a discontinuance of shipping of northern winter cabbage.—*The (Savannah, Ga.) Morning News, May 30.*

Montgomery, Ala.: crops are suffering severely from drought, and small streams are drying up. A beneficent rain fell on the 29th and 30th, breaking the drought.

Charlotte, N. C.: farmers report that the crops are drying up and that cotton is rotting in the ground. The heavy rain on the 30th broke the drought.

Hammond, Tangipahoa Parish, La.: excepting 0.03 inch of rain which fell on May 25th, there has been no rain since April 13th to May 29th, when 0.13 inch fell.—*Report of Mr. W. A. Reed to the Louisiana State Weather Service.*

Chattanooga, Tenn.: the protracted drought has been very disastrous to crops. The strawberry crop is seriously damaged, and little or no garden produce has been raised. Heavy rain fell on the 29th and 30th, breaking the drought.

Savannah, Ga.: a severe drought prevailed from the 1st to the 30th, doing much injury to crops on truck farms. Total precipitation for the month, 0.35 inch; this is the least on record for May at this station since 1871.

Augusta, Ga.: all crops in this section are suffering from the prevailing dry weather. The rain on the 30th, 0.81 inch, was the first rain of any consequence since the 1st of the month.

Fort Apache, Ariz., 31st: no rain has fallen since April 10th, and the drought is severely felt in this section.

Clinton, East Feliciana Parish, La., 31st: the month has been unusually dry. The rain of the 29th did not extend all over the parish, and the southern and southwestern portions are in need of rain. Grasshoppers are reported as doing some damage to cotton.—*Report of Mr. J. A. White, jr., to the Louisiana State Weather Service.*

Cedar Keys, Fla., 31st: the almost entire absence of rainfall during the month has severely embarrassed the farming interest in this section; cisterns in the city are dry. Records show that the least rainfall in May since the opening of the Signal Service station at this point in 1879 was 0.71, in 1886.

University, Miss., 31st: crops suffered severely from drought during the month, until the 25th; after that date rain occurred, breaking the drought.

Cameron, Cameron Parish, La., 31st: the unusual dryness during the month has damaged vegetation, and has been very unfavorable to the farming interests. The early corn is a failure, and the usual area of late corn has not been planted.—*Report of Hon. S. P. Henry to the Louisiana State Weather Service.*

Grand Coteau, Saint Landry Parish, La., 31st: the total rainfall since February 1st has been but 8.06 inches, of which 0.21 fell during the present month; the average for the same period of former years is 24.60 inches. As a consequence of the prevailing drought cotton rises slowly, and those who are late have not been able to plant. Cisterns commence to fail,

the bayous and ponds are dry, and the cattle suffer on the prairie, where the grass is parched. *Report of Rev. C. M. Widman, S. J., to the Louisiana State Weather Service.*

SUN SPOTS.

Haverford College Observatory, Pa. (observed by Mr. H. V. Gummere):

Date, May, 1889.	Number of new—			Disappeared by solar rotation.			Reappeared by solar rotation.			Total number visible.			Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
2, 10 a. m ...	0	0	0	0	0	0	0	0	0	0	0	0	Definition very good.
4, 12 m.	0	0	0	0	0	0	0	0	3	5	0	0	Definition fair.
6, 11 a. m.	0	0	0	0	0	0	0	0	2	15	0	0	Definition very good.
7, 12 m.	0	0	0	0	0	0	0	0	1	14	0	0	Definition fair.
8, 10 a. m.	0	0	0	0	0	0	0	0	1	9	0	0	Definition fair.
10, 10 a. m.	0	0	0	0	0	0	0	0	1	1	0	0	Definition poor.
14, 11 a. m.	0	0	0	0	0	0	0	0	2	2	0	0	Definition good.
15, 11 a. m.	0	0	0	0	0	0	0	0	4	42	0	0	Definition very good.
17, 9 a. m.	0	0	0	0	0	0	0	0	3	27	0	0	Definition very good.
18, 10 a. m.	0	0	0	0	0	0	0	0	0	1	1	0	Definition poor.
21, 10 a. m.	0	0	0	0	0	0	0	0	1	2	0	0	Definition good.
22, 9 a. m.	0	0	0	0	0	0	0	0	1	2	0	0	Definition very good.
23, 10 a. m.	0	0	0	0	0	0	0	0	5	9	0	0	Definition very good.
25, 10 a. m.	0	0	0	0	0	0	0	0	5	9	0	0	Definition very good.
29, 11 a. m.	0	0	0	0	0	0	0	0	0	0	0	0	Definition very poor.
30, 11 a. m.	0	0	0	0	0	0	0	0	1	6	0	0	Definition very good.

Mr. John W. James, Riley, McHenry Co., Ill.: one group of four or five spots was observed on east edge of sun, 6th; vanished between 8th and 10th. No others seen during the rest of the month. Mr. C. E. Bozzell, Leaf River, Ogle Co., Ill., May 5th: a group of spots, surrounded by prominent faculae, appeared by rotation on east limb, south of equator. This group was in a constant state of change, and disappeared on the 9th. Mr. M. A. Veeder, Lyons, Wayne Co., N. Y., May 19th: western faculae disappeared by rotation; extensive faculae, eastern quadrant; 20th and 21st, no observation taken. 22d to 25th, inclusive, faculae only—not bright. 26th to 30th, inclusive, observation poor, faculae only. 31st, no observation.

SHOWER OF FISHES.

Wichita, Kans.: during a thunder-storm which occurred the afternoon of the 10th a shower of fishes, from one to four inches long, fell at the Burton Car Works, four miles north of this city. They covered the ground in thousands. One, brought to police headquarters, was a small catfish about three and three-fourths inches long, such as abound in the streams hereabouts.—*Report of Signal Service observer.*

RAIN FROM CLOUDLESS SKY.

Portland, Oregon, 4th: at 2.10 a. m. rain fell for five minutes in small fine drops, with a perfectly clear sky, and wind blowing at the rate of about one mile per hour.—*Report of Signal Service observer.*

VERIFICATIONS.

The percentages of the official forecasts of the Signal Service for May, 1889, were not completed in time to be published in this issue of the REVIEW.

Percentages of local verifications of weather and temperature signals as reported by directors of the various State Weather Services for May, 1889.

States.	Weather.	Tem- pera- ture.	States.		Weather.	Tem- pera- ture.
			States.	Weather.		
Illinois.....	68.8	65.5	Nebraska.....	83.1	90.7	
Indiana.....	77.1	81.6	New Jersey.....	77.4	83.2	
Kansas.....	85.6	86.0	New York.....	84.0	81.0	
Kentucky.....	87.0	84.0	North Carolina.....	79.1	77.6	
Louisiana (Northern).....	76.0	84.0	Ohio.....	81.1	86.0	
Louisiana (Southern).....	88.0	95.0	Pennsylvania.....	83.0	87.0	
Michigan.....	72.5	71.8	South Carolina.....	85.0	89.0	
Minnesota.....	81.0	79.0	Tennessee.....	88.7	84.6	

STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts are republished from reports for May, 1889, of the directors of the various state weather services:

ALABAMA.

SUMMARY.

Temperature.—The cool periods of the month were the 4th, 23d, and 31st. The last date was unusually cool for the season, producing in many sections a slight frost, but this frost was so slight that little damage was done to tender vegetation. The average temperature during the month was 3.8 below normal. Monthly mean, 69.5; highest monthly mean, 79, at Union Springs; lowest monthly mean, 63, at Valley Head; maximum, 95, at Elkmont, 9th; minimum, 37, at Elkmont, 23d; range for state, 58; greatest local monthly range, 58, at Elkmont; least local monthly range, 34, at Union Springs.

Precipitation.—The month has been exceedingly dry, but little rain falling before the close of the month. On the 13th a slight precipitation occurred, produced by the effects of the low wave that passed across the middle part of the United States. The heaviest precipitation was developed on the 29th and 30th, when an excellent fall of rain occurred, producing a fine effect upon the suffering crops. The average precipitation for the month was small, being 2.23 below the normal. Average for the state, 1.95; greatest, 4.64, at New Market; least, 0.05, at Bermuda.

Wind.—Prevailing direction, northwest.—*P. H. Mell, Signal Corps, Assistant, director.*

ARKANSAS.

SUMMARY.

Temperature.—Monthly mean, 68.1; highest monthly mean, 74.0, at Washington; lowest monthly mean, 61.9, at Dallas and Heber; maximum, 93, at Helena, 17th-18th; minimum, 34, at Melbourne, 3d; range for state, 59; greatest local monthly range, 60, at Lead Hill; least local monthly range, 39, at Alexander.

Precipitation.—Average for the state, 2.86; greatest, 5.81, at Melbourne; least, 0.91, at El Dorado.—*Prof. John C. Branner, Little Rock, director; W. U. Simons, Sergeant, Signal Corps, assistant.*

ILLINOIS.

SUMMARY.

Temperature.—Monthly mean, 61.0; maximum, 94, 9th, 10th, and 11th; minimum, 26, 2d; mean of maximum, 90.4; mean of minimum, 35.2; monthly mean of maximum and minimum, 62.8.

Precipitation.—Average monthly for the state, 4.98.

Wind.—Prevailing direction, southwest.—*John Craig, Sergeant, Signal Corps, Springfield, in charge.*

INDIANA.

SUMMARY.

Temperature.—May, 1889, was, in general, a cool month, resembling that month in 1888, 1885, and 1883. The mean temperature was 3.9 below the normal for eighteen years, and 1.4 below that of seven years. The range in temperature was large, the mean daily range being 20. Periods of excessively high temperature occurred from the 7th to 11th, with the maximum temperature 90, and slightly higher, at nearly all stations on the 9th and 10th, and from the 16th to 18th. Very cool weather prevailed from the 1st to 3d, 21st to 23d, and 29th to 31st. Moderate hoar frost formed from the 1st to 6th at many stations in the southern part of the state, and ice formed in some localities of that section on the 2d and 3d, and in the central portion, 23d. Monthly mean, 60.7; highest monthly mean, 64.8, at Jeffersonville; lowest monthly mean, 57.3, at Columbia City; maximum, 93, at La Fayette, 10th; minimum, 25, at Delphi, 3d; range for state, 68; greatest local monthly range, 64, at New Providence; least local monthly range, 45, at Butlerville.

Precipitation.—The rains on the 29th and 30th were quite heavy and continuous in the central portion of the state. The amount of precipitation for the month is, with few exceptions, from 1.00 to 3.00 above the normal; the average precipitation for the state is 1.28 above the normal. The greatest amount fell in the northern portion, and the least in the southern, but that the rainfall was not equally distributed in various localities is indicated by the comparatively small amounts measured, and deficiencies at Worthington and Farmland, the one in the southern, the other in the central, portion. Average for the state, 5.50; greatest, 7.25, at Delphi; least, 2.90, at Worthington. The drought which preceded the month was ended, at most stations, by moderate rains on the 11th and 12th, and from the 19th it rained nearly every day, and in the latter part of the month was accompanied by exceptionally cool temperature.

Wind.—Prevailing direction, southwest.—*Prof. H. A. Huston, La Fayette, director; C. F. R. Wappenhans, Sergeant, Signal Corps, assistant.*

IOWA WEATHER CROP BULLETIN SERVICE.

The month was generally favorable to crops throughout the state, the temperature being slightly above and the rainfall nearly normal. Frost was reported on the mornings of the 1st, 2d, 3d, 21st, 22d, and from the 28th to the 31st. The resultant damage, however, was not extensive; corn and potatoes on low ground were injured to some extent, and some of the more tender garden vegetables were killed.

SUMMARY.

Temperature.—Monthly mean, 59.1; highest monthly mean, 64.9, at Wash-

ington; lowest monthly mean, 51.1, at Fayette; maximum, 92, 9th, at Washington and at Glenwood, 8th; minimum, 26, at Wesley, 1st and 31st; range for state, 66; greatest local monthly range, 62, at Iowa City and Logan; least local monthly range, 38, at Gillett.

Precipitation.—Average for the state, 4.58; greatest, 8.54, at Dunkerton; least, 1.95, at Wesley.—*G. M. Chappel, Sergeant, Signal Corps, Des Moines, in charge, Iowa Weather Crop Bulletin Service.*

KANSAS.

SUMMARY.

Temperature.—The mean temperature for the state, 62.9, is slightly below the May normal. In the eastern division it is deficient, ranging from 1 below the normal in the northern portion to 2 below in the southern portion. In the central division it is about normal, while in the western it ranges from 1 above in the southern counties to about 2 below in the northern. Highest monthly mean, 70.9, at Ellsworth; lowest monthly mean, 55.3, at Grainfield; maximum, 100, at Gibson, Hugoton, and Offerle, 22d; minimum, 26, at Concordia, 3d; range for state, 74; greatest local monthly range, 72, at Gibson; least local monthly range, 42, at Sedan; greatest daily range, 52, at Gibson, 22d; least daily range, 2, 17th, at Seneca.

Precipitation.—The average precipitation over the state is 5.48, and is excessive. The largest excess extends diagonally across the state from the northwest to the southeast, culminating in McPherson and Coffey counties, where it reaches the decidedly unusual amount of 11.00 and 12.00, respectively. Northeastward from this belt the rainfall diminishes, being 5.00 and 6.00 in Franklin and Shawnee counties, respectively; it then rapidly increases to 9.00 and upwards in Johnson and Leavenworth. Another decided excess occurs in Chautauqua, where 11.00 fell. Southwest of the "excess belt" the excess rapidly changes to a deficiency, which culminates in the extreme southwestern counties, where less than 1.00 fell during the month. During the month a greater part of the rain fell on the 10th, 11th, 12th, 23d, 24th, and 28th. Greatest, 12.14, at Lebo; least, 0.20, at Hugoton.

Wind.—Prevailing direction, south.—*Prof. J. T. Lovewell, Topeka, director; T. B. Jennings, Sergeant, Signal Corps, assistant.*

KENTUCKY.

SUMMARY.

Temperature.—The mean temperature of the state, as deduced from the tri-daily observations, was 63.6, and from the average of the maximum and minimum temperatures, 63.8. These figures indicate a deficiency of about 2 less than the normal. Highest temperature, 94.4, at Frankfort, 10th; lowest, 28, at Shelbyville, 4th; greatest monthly range, 63.4, at Frankfort; least, 45, at Ashland and Franklin.

Precipitation.—The average rainfall for the state, 4.03, is very slightly in excess of the normal. Greatest amount, 5.44, at Franklin; least, 2.46, at Falmouth. The rain was very unevenly distributed throughout the month; none at all was recorded up to the 10th, and from that date the showers were very light and scattering. On the 30th and 31st, tremendous rains fell in all parts of the state; the average amount for those two days probably exceeding 3.00. This largely reduced the existing deficiency, but at the central station on June 1st more than 8.00 was still required to bring the rainfall to the normal amount since January 1st.

Wind.—Prevailing direction, southwest.—*Dr. E. A. Grant, Louisville, director; Frank Burke, Sergeant, Signal Corps, assistant.*

LOUISIANA.

SUMMARY.

The month was characterized by a greatly deficient rainfall, the least on record for the month for the state; absence of rainy days; low temperature in the earlier and latter parts of the month, and a warm and dry period from the 5th to the 28th. The dates of general rains in the northern portions of the state were the 1st, 13th, 18th, and 29th.

Temperature.—Monthly mean, 72.2; highest monthly mean, 75.2, at Cameron; lowest monthly mean, 68.0, at Donaldsville; maximum, 101, at Cameron, 27th; minimum, 40, at Lake Providence, 3d; range for the state, 61; greatest local monthly range, 55, at Clinton; least local monthly range, 25, at Port Eads; mean daily range, 24.1.

Precipitation.—Average for the state, 1.04; for the northern section, 1.62; southern section, 0.66; greatest local monthly rainfall, 3.11, at Coushatta; least, 0.06, at Baton Rouge; greatest daily rainfall, 1.88, at Shreveport, 18th.

Wind.—Prevailing direction, south.—*R. E. Kerkam, Sergeant, Signal Corps, New Orleans, in charge.*

MICHIGAN.

SUMMARY.

The most remarkable feature of the month was the storm of the 29th-30th. This storm, which was central over the state on the 30th, was accompanied by heavy rain, and on the morning of the 30th by snow. The rainfall averaged over 3.00 for the south half of the state for the two days, many stations reporting a fall of over 2.50 in twenty-four hours.

SUMMARY.

Temperature.—The mean temperature for the month, 54.0, is 2.6 below the

normal of fourteen years. Highest monthly mean, 58.5, at Marshall; lowest monthly mean, 46.5, at Calumet; maximum, 93, at Gladwin, 18th; minimum, 20, at Bellaire, 28th, range for the state, 73; greatest local monthly range, 72, at Gladwin; least local monthly range, 46, at Fremont; greatest daily range, 53, at Evart, 12th; least daily range, 2, 29th, at Mottville.

Precipitation.—The average precipitation, 4.08, is 0.68 above the average of fourteen years; greatest, 7.82, at Standish; least, 1.16, at Marquette.

Wind.—Prevailing directions, southwest and northwest.—*N. B. Conger, Sergeant, Signal Corps, Lansing, director.*

MINNESOTA.

In the northwestern part of the state the monthly mean temperature coincided with the normal, in the western-central portion there was a deficiency of 1, and in the southern and southeastern counties the month was from 3 to 4 cooler than usual. Along Lake Superior the temperature was slightly in excess. The frosts from the 28th to 31st damaged potatoes and other vegetables, and cut or hindered the growth of corn. There was only about 60 per cent. of the usual precipitation for the season. The rains, however, were beneficial and timely. Some of the local deficiencies are as follows: Saint Paul and Minneapolis, 14 per cent.; La Crosse, Wis., 28; Moorhead, 41; Duluth, 46; and Saint Vincent, 71.

SUMMARY.

Temperature.—Monthly mean, 54.2; highest monthly mean, 57.6, at Red Wing; lowest monthly mean, 46.3, at Pokegama Falls; maximum, 88, at Morris, 6th; minimum, 17, at Pokegama Falls, 28th; range for state, 71; greatest local monthly range, 67, at Moorhead; least local monthly range, 43, at Minneapolis; greatest daily range, 47, at Saint Vincent, 3d; least daily range, 4, at Duluth, 14th.

Precipitation.—Average for the state 1.95; greatest, 3.06, at Minneapolis; least, 0.81, at Saint Vincent.

Wind.—Prevailing direction, northwest.—*Prof. W. W. Payne, Northfield, director; John Healy, Private, Signal Corps, Saint Paul, assistant.*

MISSISSIPPI.

SUMMARY.

Temperature.—During the first three days of the month the mean temperature throughout the state was between 58 and 60, the maximum and minimum being about 70 and 50. After the 3d the mean temperature remained nearly 73, until the 16th, when there was a rise to 80, succeeded by a fall to 68, on the 21st, and then an average mean of 74, until the 30th. On the 31st the mean throughout the state was about 55. The mean temperature for the state was 70, the normal being 72.3. The local daily range of temperature was never less than 10, and generally between 18 and 28. The mean maximum temperature for the state was 82.6, and the mean minimum, 57.9. Remarkably slow changes in temperature occurred except at the very last of the month. Many stations report the same mean temperature on the 3d, 4th, 8th, 9th, 10th, 19th, 26th and 27th. Light frost was reported at some stations in the northern part of the state on the 2d, 3d and 4th, and generally in the central and northern parts on the 31st. No damage resulted.

Precipitation.—The average rainfall for the state was 1.31, the normal being 4.15. The rains were badly distributed, varying in quantity from 4.03, at Greenville, to 0.45, at Waynesborough. At nearly all stations the deficiency was seriously felt in delaying the growth of crops. The deficiency for the month is 2.84, and for the year, 11.70 throughout the state. Long records seem to show that the May rainfall is more variable than that of any other month in Mississippi. Amounts less than the above fell in May, 1874, and 1886. No rain exceeding 1.50 in twenty-four hours was reported.—*R. B. Fulton, Signal Corps, University, director.*

MISSOURI.

SUMMARY.

Temperature.—The mean temperature for May was 64.6. The highest reported in the state was 96, at Protec, and the lowest, 28, at Ozark. The average of maximum temperatures was 88.6, and the average of minimum temperatures 38, making an average range of 50.6. The highest temperatures occurred on the 6th to 10th, 15th, 16th and 23d, and the lowest on the 1st, 2d, 3d, 17th, 23d, 30th and 31st.

Precipitation.—The average precipitation, 6.42, is 2.87 above the May normal; greatest, 10.70, at Shelbina; least, 2.75, at Oak Ridge. In the state precipitation occurred on twenty-four days. The greatest number of days of precipitation in any one place was fifteen at Oregon.—*Prof. Francis E. Nipher, Saint Louis, director; W. H. Hammon, Sergeant, Signal Corps, assistant.*

NEBRASKA.

SUMMARY.

Temperature.—The temperature of the month for southeastern Nebraska was 62.1, which is only slightly above the normal. There were less than the usual number of hot days, while there has been an almost entire absence of freezing weather, only slight damage to vegetation being anywhere reported in the state.

Precipitation.—The rainfall for May shows considerable resemblance to that for April; the region of the least rainfall in both cases is in the central part of the state. At Ravenna the normal rainfall for the two months for twelve years is 6.4; for the past two months it has amounted to 3.5. At North Loup, where the rainfall for the past month was less than 1.00, it increased rapidly and somewhat regularly to the southeast, reaching a maxi-

mum of nearly 8.00, at Fairbury. The northwestern part of the state has received about 3.00. There has not been so great a deficiency in rainy days as in amount of rain, except in a limited area in the central part of the state.—*Prof. Goodwin D. Sweeny, Crete, director; G. A. Loveland, Corporal, Signal Corps, assistant.*

NEVADA.

The remarkable features of the weather during the past month were the heavy storms of the 5th to 8th and 15th to 17th, the remainder of the month being attended with fine spring-like weather. The storm on the 5th, which was general throughout the state, is the heaviest on record for the past ten years, and was characterized by unusually cold weather and very heavy rainfall in all sections.

SUMMARY.

Temperature.—The mean temperature, 57.8, was a trifle below the average. The warm periods were from the 24th to the 29th; the highest temperature for the state, 106.0, occurring on the 28th and 29th, at El Dorado Canyon. There were two cold periods, from the 6th to 8th and from the 15th to 17th. The lowest temperature reported, 20.0, occurred at Wellington, 8th, and at Ruby Hill, 16th. The total range of temperature between the warmest and coldest stations was 86.

Precipitation.—The rainfall throughout the state was greatly in excess of the average, and was particularly so in the northern and western counties. The long-continued drought which threatened this section of the country for some time past has at last been broken; the aspect of the country has been entirely changed, and crops of all kinds have been materially improved. The prospects are at present more encouraging than they have been at any time this season.—*Prof. Chas. W. Friend, Carson City, director; H. F. Alciator, Private, Signal Corps, assistant.*

NEW ENGLAND METEOROLOGICAL SOCIETY.

The month of May, 1889, may be characterized as generally warm and moist, with an absence of high winds, an undue amount of fog on the coast, and a small number of thunder-storms.

The temperature, while generally high, showed marked extremes. Readings above 90 were numerous on the 9th and 10th, and light frosts occurred on the 26th and 29th. The average for the month is about 2 above the normal.

SUMMARY.

Temperature.—Monthly mean, 59.2 (103 stations); highest monthly mean, 64.8, at Hartford; lowest monthly mean, 48.7, at Eastport; maximum, 98, at Westborough, 9th; minimum, 25, at Berlin Falls, 13th; range for New England, 73; greatest local monthly range, 71, at Berlin Falls; least local monthly range, 29, at Nantucket; greatest daily range, 55, at Berlin Falls, 13th; least daily range, 1, at Nantucket, 26th. The average temperature for May for 21 stations, having records for more than 10 years, is 55.6; the average for May, 1889, is 58.5; departure, +2.9.

Precipitation.—Average for New England, 3.57 (132 stations); greatest, 6.45, at Newburyport; least, 1.50, at Pomfret. The average precipitation for 31 stations, having records for more than 10 years, is 3.54; the average for May, 1889, is 3.89; departure, +0.35.

Wind.—Prevailing direction, southwest (23 stations).—*Prof. William B. Niles, Boston, Mass., president; Prof. Winslow Upton, Providence, R. I., secretary; L. G. Schultz, Sergeant, Signal Corps, assistant.*

NEW JERSEY.

SUMMARY.

Temperature.—The mean temperature for May, 1889, 62.3, is 2.6 above the average for the month, and 9.9 above the average for the corresponding month of 1888. The warm periods were from the 5th to 11th and 16th to 18th, inclusive. The highest temperature during the month was recorded at all stations on the 10th, and ranged from 87 to 94. The first four days of the month were the coolest, several stations reporting light, harmful frosts on these dates. Highest monthly mean, 67.0, at Trenton; lowest monthly mean, 58.0 at Atlantic City; maximum, 94.0, at Tenafly, 10th; minimum, 32.0, at Allaire, 2d; range for state, 62.0; greatest local monthly range, 59.0, at Tenafly; least local monthly range, 40.0, at Readington; greatest daily range, 46.0, at Plainfield and Tenafly, 5th and 9th, respectively; least daily range, 1.0, at Billingsport, Moorestown, and Oceanic, 27th.

Precipitation.—The average precipitation for the state, 4.09, is 0.35 above the average for the month, and is 0.83 below the average for the corresponding month of 1888; greatest, 6.60 at Bridgeton; least, 2.43 at Newark. Very little rain fell during the first nineteen days, during which time the growing crops were in a flourishing condition in all parts of the state. The last twelve days were unusually wet and unfavorable for farming operations.

Wind.—Prevailing direction, northwest and southwest. The high winds during the month caused considerable damage.—*Prof. George H. Cook, New Brunswick, director; E. W. McGann, Sergeant, Signal Corps, assistant.*

NEW YORK.

SUMMARY.

Temperature.—Highest temperature, 95, at Utica, 18th; lowest, 26, at Number Four, 4th, and at Alfred Centre, Angelica, and Arcade, 29th. Mean temperature for the state, 58.5. The 18th was the hottest and the 3d the coldest day. The temperature was generally above the average excepting at Buffalo, where it was 0.2; Central Park, 2.9; Utica, 4.1, and Le Roy, 0.1 below.

Precipitation.—The average precipitation for the state was 3.15. The rainfall was above the average except at Ardenia, where it was 0.94; Boyd's Corners,

1.96; Buffalo, 0.29; Erie (Pa.), 0.87; Ithaca, 1.03; Le Roy, 0.20; Oswego, 1.07; Palermo, 1.47; Rochester, 0.60; Utica, 0.87, and White Plains, 1.19 below. Snow fell at Friendship on the 1st, and at Humphrey and Middleburgh on the 2d. The average number of days on which the precipitation was 0.01 or more of rain or snow was 11.

Wind.—Prevailing direction, south.—*Prof. E. A. Fuertes, Ithaca, director; I. W. Brewer, Private, Signal Corps, assistant.*

NORTH CAROLINA.

SUMMARY.

Temperature.—Monthly mean, 67.8; highest monthly mean, 74.7, at Southern Pines; lowest monthly mean, 62.2, at Hot Springs; highest temperature, 98, at Southern Pines and Fayetteville, 11th; lowest temperature, 30, at Asheville, 4th; range for state, 68.

Precipitation.—Monthly average for the state, 4.53; greatest monthly, 8.48, at Weldon; least, 2.54, at Kitty Hawk.

Wind.—Prevailing direction, north.—*Dr. Herbert B. Battle, Raleigh, director; H. McP. Baldwin, Private, Signal Corps, assistant.*

OHIO.

SUMMARY.

Temperature.—The mean of the northern section was 58.7; of the middle section, 60.4, and of the southern section, 61.7; these means are 0.4, 0.4, and 1.2 below the averages for the sections. The mean for the state, 60.2, is 0.7 below the average for May. The maximum temperature was 96 at Wapakoneta, 10th, and the minimum, 25.6, at Wauseon, 1st. The greatest daily range was 50, at Logan, 9th, and the smallest, 3.9, at Sidney, 30th.

Precipitation.—Precipitation was general and heavy in all sections on the 11th, 13th, 14th, 19th, 20th, 22d, 27th, 29th, 30th, and 31st; in the northern section on the 10th and 21st, and in the southern section on the 23d, 24th, and 25th. Local rains occurred in the northern and middle sections on the 12th. About one-half the rainfall for the month fell during the last three days. Snow was reported from Greenville, Upper Sandusky, Bangorville, and Fostoria on the 22d, and hail from stations in the northern section on the 10th, 11th, and 14th; in the middle section on the 10th, 22d, and 27th, and in the southern section on the 13th, 22d, and 27th. The mean rainfall for the month in the northern section was 3.95; in the middle section, 3.78, and in the southern section, 3.35. The rainfall in the northern section was 0.12 above the average. In the middle and southern sections the means are 0.57, and 0.71 below the averages for the sections. The mean for the state, 3.71, is 0.88 below the average for May. The deficiency in rainfall for the year to June 1st amounts to 1.66 in the northern section; 4.95 in the middle section, and 6.97 in the southern section. The deficiency for the state amounts to 4.42.

Wind.—Prevailing direction, south.—*Prof. B. F. Thomas, Columbus, director; Lieut. Charles E. Kilbourne, secretary; C. M. Strong, Corporal, Signal Corps, assistant.*

PENNSYLVANIA.

SUMMARY.

Temperature.—The mean temperature for May, 1889, 62.0, is 1 above the average. The warmest period of the month occurred on the 9th, and the coldest on the 2d, 4th, and 29th. Frosts were general throughout the state on these dates. The highest temperatures reported were Carlisle, 96; Hollidaysburgh, Reading, Coatesville, and York, 94. The lowest temperatures were Emporium, 25; New Castle, Columbus, and Dyberry, 26. The highest mean monthly temperatures were Indiana, 68.3; Annville, 66.5, and Emporium, 64.5. The lowest were Wellsborough, 55.1; Columbus, 56.0; Dyberry, 56.3.

Precipitation.—The average rainfall over the state during the month was 5.91, which is an excess of over 2.00. Had it not been for the phenomenal rainfall of the 31st, there would have been a deficiency in the western and middle portions of the state. The largest totals for the month were McConnellsburgh, 12.41; Grampian Hills, 11.60; Charlesville, 11.07; Harrisburg, 9.51; Smethport, 9.21, and Selin's Grove, 9.20. The excessive and unprecedented rainfall of the 31st, which caused disastrous floods, was at Grampian Hills, 8.37; McConnellsburgh, 7.08; Charlesville, 6.71; Selin's Grove, 6.00; Emporium, 5.85; Smethport, 5.50; Hollidaysburgh, 5.12, and Harrisburg, 4.06. In the southeastern portion of the state the fall was very light on this date, many stations reporting less than 0.10. From the 1st to the 10th there was a general absence of rain. From this time to the end of the month rains occurred almost daily at some stations. On the 31st the central portion of the state was visited by one of the greatest rainfalls and floods ever known in this country for magnitude and destructiveness. Large sections were flooded, whole towns and cities were swept away; thousands of people drowned, and millions of dollars in property destroyed. It is estimated that from six to eight inches of rain fell in twenty-four hours over a large area of the central part of the state.

Wind.—Prevailing direction, west.—*Under direction of the Franklin Institute, Philadelphia; T. F. Townsend, Sergeant, Signal Corps, assistant, in charge.*

SOUTH CAROLINA.

SUMMARY.

Temperature.—The mean temperature, 71.7, is 0.2 above the normal; greatest monthly mean, 74.9, at Florence; lowest monthly mean, 68.5, at Trial; maximum, 101, at Chester, 11th; minimum, 35, at Cedar Springs, 4th, and George's, 5th. Range for the state, 66; greatest local monthly range, 63, at George's; least local monthly range, 41, at Camden.

Precipitation.—The average for the state, 1.97, is 2.25 below the normal; greatest, 5.64, at Florence; least, 0.45, at Beaufort; greatest daily rainfall, 4.92, at Florence, 31st. Average number of rainy days, 4.8.

Wind.—Prevailing direction, northwest.—*Hon. A. P. Butler, Columbia, director; H. C. Seymour, Private, Signal Corps, assistant.*

TENNESSEE.

The month of May had several abnormal features, among which were the periods of low temperature during the first week and the last two days, both resulting in frost; the high winds which prevailed at various times during the month, and the heavy rainfall during the last week. The percentage of cloudiness was below the normal.

SUMMARY.

Temperature.—The mean temperature, 64.7, is slightly below the average for the past seven years. The highest local monthly mean was 71.2, at Woodstock, and the lowest was 60.1, at Cog Hill. The highest temperature observed was 92, on the 17th at Watkins, Hohenwald, and Bolivar, and the lowest was 30, on the 4th at Rogersville. This was the lowest May minimum during the past seven years, except that of last year which was the same, and was also the same as the April minimum of last year. The highest temperature was generally recorded on the 10th in the eastern division, and on the 17th in the middle and western divisions, while the lowest was recorded generally on the 3d, 4th, and 31st. The daily ranges of temperature were in excess of the normal for May.

Precipitation.—The average amount of rainfall during the month was 3.80, a little less than the May average for the past seven years. Of this amount the eastern division received an average of more than 4.50, the middle division about 4.00, and the western about 2.50. The larger proportion of this fell on the 25th, 29th, and 30th. The greatest rainfall occurred on the 29th and 30th, when an average of nearly two inches fell throughout the state. The rains of the 1st, 12th, 13th, 25th, 29th, and 30th were general; that of the 18th was confined principally to the middle and western divisions; that of the 19th principally to the middle and eastern divisions, and that of the 26th to the eastern division; the others were generally light, local rains. The greatest local monthly rainfall was 6.89, at Kingston, and the least was 1.48, at Memphis. The greatest local daily rainfall was 3.52 on the 30th, also at Kingston, which station showed the remarkable amount of 4.52 inches on the two days—29th and 30th.

Wind.—Prevailing directions, south and southwest.—*J. D. Plunket, M. D., Nashville, director; H. C. Bate, Signal Corps, assistant.*

TEXAS.

SUMMARY.

Temperature.—The mean temperature for May was highest over the southwestern portion of the state, where it rose to 75, at Brownsville, and no point along the coast west of Galveston, where the mean is 73, reports a mean less than 74. Means above 70 were reported in the eastern portion of the state as far north as the thirty-third parallel. In the western portion of the state, Silver Falls and El Paso each reported a mean of 73. The mean temperature was generally from 2 to 4 below the normal over the state, except over the Panhandle and the extreme western portion, where an excess of from 2 to 4 was reported. The highest temperature reported was 102, at Pecos City, 14th, and the lowest, 34, at Silver Falls, 1st.

Precipitation.—The rainfall has been deficient over the entire state, with the exception of a strip about fifty miles wide along the coast between Columbia and Corpus Christi, where reports show an excess ranging from 1.00 to 3.00. The greatest departure from the normal is over that section north of the twenty-ninth parallel and east of the ninety-eighth meridian, where the deficiency ranged from 2.00 to 4.00. Over that section between the ninety-eighth meridian and the one hundred and second meridian the deficiency ranged from 1.00 to 2.50, being greatest over the east half of the Panhandle. The rainfall over that portion of the state west of the one hundred and second meridian did not exceed 0.05. General and well distributed rains fell over the state from the 16th to 19th, and from the 24th to 29th.—*S. O. Young, M. D., Galveston, director; I. M. Cline, Sergeant, Signal Corps, assistant.*

Meteorological record of Army post surgeons and voluntary observers, May, 1889.

Stations.	Temperature. (Fahrenheit.)			Precip. in.	Stations.	Temperature. (Fahrenheit.)			Precip. in.
	Max.	Min.	Mean.			Max.	Min.	Mean.	
Alabama.					Alabama—Cont'd.	0	0	0	Ins.
Auburn	89	45	70.1	1.52	Motes	87	38	68.7	4.11
Bermuda f.	90	45*	67.8	0.05	Mt. Vernon B'ks	93	42	71.0	2.62
Centre	88	42	65.0		Mount Willing f.	88	45	69.8	1.05
Citronelle f.	95	42	71.3	2.32	New Market f.	89	37	65.1	4.64
Columbiana f.	91	27	67.8	0.80	Opelika f.	94	44	71.4	1.40
Decatur (1) f.				2.00	Pine Applef.	96	40	70.7	70.03
Decatur (2) f.	94	31	66.0	1.16	Selma f.	93	43	71.4	1.03
Elkmont f.	95	37	66.5	2.42	Talladega	88	42	70.6	1.90
Eufaula f.	91	42	70.5	1.15	Troy f.	91*	41	72.8	1.42
Florence	86	46	64.4	2.43	Tuscaloosa	87	41	72.5	2.22
Fort Deposit f.	93	42	71.2	1.33	Tuscumbia (1) f.	92	45	66.9	2.48
Gadsden f.	92	38	68.7	1.60	Tuscumbia (2) f.	91	32	65.8	1.506
Greensborough	90	42	70.7	0.61	Union Springs	92	48	79.0	1.23
Livingston (1) f.	91	42	69.2	0.69	Uniontown	90	41	72.9	0.10
Livingston (2) f.	90	41	71.4	0.34	Valley Head f.	90	34	62.5	3.44
Marion f.	91	37	68.3	0.37	Wiggins	96	42	70.9	1.57

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean	
Alaska.	0	0	0	Ins.
Killisnoo.	61	33	47.2	2.95
Arizona.				
Antelope Valley.			0.00	
Benson*.	98	57	77.6	0.00
Casa Grande*.	104	62	79.1	0.00
Cedar Springs.			0.00	
Curtis*.		52	69.2	T.
Flagstaff.	95	19	62h	0.65
Fort Apache.	92	30	61.5	0.00
Fort Bowie.	92	44	70.2	0.09
Fort Huachuca.	90	44	69.6	0.00
Fort Lowell.	105	37	71.5	0.00
Fort McDowell.	110	45	75.9	0.00
Fort Mojave.	108	50	78.2	0.26
Fort Verde.	100	34	67.2	T.
Globe.	98			0.00
Holbrook*.	94	29	65.4	0.09
Maricopa*.	105	60	78.2	0.00
Mount Huachuca*.			T.	
New River.	80	42	59.2	T.
Pantano*.	99	55	76.3	0.00
Peoria.	107	45	76.5	T.
Phoenix.	108	48	79.0	0.00
San Carlos.			0.00	
San Simon*.	106	40	75.0	0.00
Signal.			T.	
Strawberry.			0.00	
Teviston.			0.00	
Texas Hill*.	100	60	82.8	0.00
Tombstone.	93	36	65.4	...
Tucson (1)*.	96	48	64.2	T.
Tucson (2)*.	99	49	70.3	0.00
Volunteer Springs.	87	17	52.1	0.90
Walnut Grove.			0.00	
Wilcox*.	98	54	73.0	0.00
Williams.	83	23	52.2	T.
Willow Springs.			0.00	
Winslow.			0.00	
Arkansas.				
Alexander.	87	48	67.0	2.95
Arkansas City f.			2.82	
Brinkley*.	87	45	70.0	0.05
Camden f.			3.12	
Conway.	87	46	66.7	4.11
Dallas f.	85	38	61.9	3.31
Dardanelle.			3.30	
Dayton.	86	43	68.3	4.67
Deville's Bluff f.	90	37	68.1	1.49
El Dorado f.	86	42	66.4	0.91
Forrest City f.	89	42	69.6	2.17
Fulton f.			1.74	
Heber.	88	37	61.9	2.75
Helena (1)*.			1.78	
Helena (2)*.	93	40	69.8	1.02
Hot Springs.	90	37	66.0	4.39
Lead Hill.	96	36	67.9	5.32
Little Rock B'ks.	88	50	67.7	2.97
Lonoke.	85	45	69.9	2.75
Marshall.	87	43	66.0	0.62
Melburnet.	91	34	66.0	5.81
Monticello f g.	91		1.50	
Newport (1)*.			2.40	
Newport (2)*.	89	43	67.1	2.49
Osceola f.	90	41	77.2	1.73
Ozone f.	84	41	65.2	3.42
Prescott f d.	87	45	70.2	0.52
Russellville f.	90	38	68.2	3.50
Stuttgart f.	86	39	66.7	1.36
Texarkana f.	90	44	70.9	2.74
Washington f.	87	40	74.6	1.96
British Columbia.				
New Westminster.	78	45	58.2	3.06
California.				
Alcide*.	106	50	71.8	...
Alcatraz Island.	77	49	56.2	2.30
Almaden*.	88	51	65.3	2.01
Anaheim*.	94	59	67.8	0.57
Anderson f.	95	45	68.6	5.99
Angel Island.	89	45	59.9	2.45
Antioch*.	97	37	67.4	1.07
Aptos*.	80	45	59.6	1.71
Athione*.	105	52	72.6	0.93
Auburn*.	89	46	63.8	4.65
Bakersfield*.	103	54	78.7	0.22
Barstow.	104	44	71.6	0.12
Benicia Barracks.	89	44	61.5	2.01
Berendo*.	102	53	74.7	1.41
Berkeley.	86	45	57.3	1.50
Bishop Creek*.	106	53	76.1	0.30
Boca*.	89	39	48.6	3.90
Borden*.	101	50	69.3	0.94
Brighton*.	100	47	68.4	2.85
Byron*.	98	54	71.1	0.98
Cactus*.	108	56	81.7	0.00
Caliente*.	99	49	70.7	0.00
Calistoga*.	93	44	63.0	3.91
Castroville*.	83	47	59.7	1.20
Centreville*.	93	50	66.2	...
Chico*.	104	48	69.7	1.76
Cisco*.	77	27	48.7	8.10
Colegrove.			0.69	
Coles*.	96	36	57.3	2.74
Colfax*.	94	35	60.5	9.14
Colton*.	100	54	66.0	0.60
Corning*.	105	45	71.2	1.38

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean	
California—Cont'd.	0	0	0	Ins.
Crescent City.				10.92
Cuyama*.	100	39	62.6	0.60
Davisville*.	100	54	69.6	1.48
Delta*.	99	40	64.8	3.87
Downey*.	94	56	66.6	0.32
Dunnigan*.	89	54	68.6	1.46
Dunsmuir*.	79	38	53.2	7.06
El Dorado*.	97	47	68.2	7.50
Elmira*.	103	50	71.6	1.67
Emigrant Gap*.	82	30	49.2	8.61
Esperanza*.	102	50	70.1	1.47
Evergreen*.				
Farmington*.	100	50	67.4	1.88
Felton*.	84	40	60.0	4.28
Florence*.	88	50	64.2	0.17
Folsom*.	98	50	69.1	3.29
Fort Bidwell.	90	30	55.7	1.62
Fort Gaston.	99	33	56.2	6.06
Fort Mason.	84	47	58.3	1.98
Fresno*.	106	50	72.9	0.00
Fruto*.	103	46	70.3	1.33
Gilroy*.	95	50	63.7	2.00
Girard*.	91	38	63.5	1.97
Glen Ellen*.	91	47	62.4	5.84
Gosher*.	102	50	76.9	1.15
Grass Valley.			7.21	
Hollister*.	93	53	65.1	1.26
Holbrook*.	102	38	63.4	2.34
Hydesville f.	81	40	56.6	5.83
Indio*.	105	62	79.5	0.90
Iron*.	100	50	67.9	4.00
Iowa Hill*.	90	40	60.4	2.46
Jolon.			1.12	
Keeler*.	95	45	69.9	0.66
Keene*.	91	42	62.6	1.77
Kingsburgh*.	100	55	75.7	0.72
King City*.	104	42	63.4	0.48
Knight's Landing*.	93	40	64.1	2.17
La Grange*.	104	46	68.5	1.64
Lathrop*.	98	55	63.7	0.85
Lemoore*.	102	51	74.9	1.13
Lewis Creek*.	100	48	73.5	1.36
Livingston*.	104	50	71.2	1.60
Long Beach*.	80	53	63.4	...
Los Angeles*.	92	52	64.5	0.57
Los Banos*.	101	50	69.0	0.64
Los Gatos*.	95	53	66.8	2.35
Mammoth Tank*.	110	50	84.0	0.00
Martinez*.	87	50	64.2	1.95
Menlo Park*.	86	48	61.9	1.68
Modesto*.	101	50	69.6	0.77
Mojave*.	99	43	68.1	T.
Montague*.	98	40	65.1	1.70
Monterey*.	81	54	61.7	1.22
Monterey* (Hotel del Monte).	68	50	60.0	...
Orville*.	92	49	68.5	3.07
Pajaro*.	83	48	60.2	1.89
Paso Robles*.	94	45	61.8	1.25
Petaluma*.	87	51	61.3	2.31
Placerville*.	94	46	66.1	8.88
Pomona*.	94	59	69.8	0.70
Presidio of San F.	84	44	55.7	0.70
Premute*.	95	54	65.9	0.40
Red Bluff*.	100	50	68.0	2.09
Redding*.	104	46	59.5	3.90
Riverside*.	102	43	64.0	0.30
Rocklin*.	102	52	70.1	2.25
Rumsey*.	100	50	70.3	2.45
Sacramento (1).	90	38	61.4	3.65
Sacramento (2)*.	87	52	65.9	2.69
Salinas (1)*.	87	49	57.0	0.68
Salinas (2)*.	76	48	59.0	0.79
Sanger Junction*.	105	54	75.8	0.84
San Ardo*.	99	45	62.6	2.27
San Bernardino.	90	46	63.5	1.13
San Diego B'ks.	82	49	62.2	...
San Fernando*.	98	46	63.2	0.43
San Gabriel*.	98	54	67.2	0.75
San Jose*.	89	51	61.9	0.96
San Luis Obispo.	90	44	59.9	1.78
San Mateo*.	84	50	59.7	1.08
San Miguel*.	93	45	63.6	0.67
San Pedro*.	83	54	66.7	0.00
Santa Ana*.	96	58	67.7	0.45
Santa Barbara (1).	83	47	60.0	0.76
Santa Barbara (2)*.	86	54	63.6	0.84
Santa Clara.			0.91	
Santa Cruz*.	72	50	59.3	1.78
Santa Margarita*.	86	47	64.2	2.14
Santa Maria.	85	40	60.0	0.60
Santa Monica*.	86	56	65.8	0.84
Santa Paula*.	88	54	65.4	0.30
Connecticut—Cont'd.	0	0	0	Ins.
Santa Rosa*.	83	42	62.6	2.93
Selma*.	98	52	73.1	0.70
Seven Palms*.	110	24	83.7	0.01
Shingle Springs*.	94	40	63.0	7.80
Sims*.	99	40	63.1	3.55
Solead*.	98	48	61.3	0.58
Soquel*.	95	50	65.8	...
South Side*.	88	48	63.3	0.38
South Vallejo*.	82	48	58.6	2.10
Spadra*.	98	50	64.0	0.61
Steeles.	89	43	58.3	1.77
Stockton (1).			1.52	

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Illinois—Cont'd.	0	0	0	Ins.	Iowa.	0	0	0	Ins.
Benson.	94	30	59.1	4.19	Amana.	86	31	59.8	4.46
Belvidere.	86	28	50.7	5.00	Ames.	86	38	60.0	4.18
Brush Hill.	94	43	62.7	4.12	Bancroft.	80	44	59.6	1.97
Camargo.	89	39	61.0	.....	Blakeville.	83	36	57.0	6.46
Cedarville.	86	37	60.5	3.32	Cedar Rapids.	84	29	58.6	5.15
Centralia.	91	42	61.0	6.33	Clarinda.	88	38	62.5	4.10
Charleston.	94	30	62.2	4.19	Clinton.	92	22	59.9	3.53
Chicago.	90	34	59.5	5.50	Cresco.	80	29	56.0	4.18
Collinsville.	88	39	62.6	3.38	Cromwell.	.....	33	60.4	3.50
Dwight.	90	28	59.8	4.24	Denmark.	84	38	57.7	4.72
Fairfield.	92	42	67.1	4.40	Des Moines.	87	32	61.1	.....
Flora.	94	34	63.0	4.58	Dunkerton.	84	36	60.3	8.54
For Sheridan.	89	35	55.7	3.22	Dysart.	81	34	56.8	6.40
Golconda.	90	42	65.5	3.38	Eagle Grove.	85	32	58.1	6.45
Grand Tower.	.....	.....	3.71	Elkader.	82	42	60.1	4.65	
Greenville.	90	35	61.3	7.10	Fayette.	83	27	56.1	4.58
Griggsville.	94	47	67.4	9.38	Fort Madison.	89	38	63.4	5.61
Hennepin.	94	29	59.6	4.12	Gillett.	.....	43	57.0	2.90
Hillsborough.	88	40	65.2	8.63	Glenwood (1).	92	34	65.1	5.20
Irishtown.	90	42	63.2	4.93	Glenwood (2).	90	30	59.2	4.05
Jordans Grove.	92	36	65.8	3.68	Grinnell.	83	33	59.8	6.76
Lacon.	93	38	60.6	3.92	Humboldt.	82	24	56.29	4.11
Lake Forest.	88	31	54.8	4.60	Independence.	79	42	59.7	5.88
Lanark.	84	39	60.2	3.55	Iowa City.	80	37	60.0	3.28
Mascoutah.	89	40	60.0	4.90	Le Claire.	.....	5.13	.....	.....
Mattoon.	92	31	60.4	5.33	Logan.	90 ²	28	62.7	3.28
McLeansborough.	94	39	63.8	2.80	Manson.	84	34	57.2	4.56
Mount Carmel.	.....	.....	5.60	Maquoketa.	86	40	59.6	5.08	
Mount Morris.	93	35	56.8	2.90	Monticello.	86	32	59.9	4.56
Olney.	91	39	63.8	4.70	Mount Pleasant.	82	43	60.7	5.83
Oneida.	90	34	59.6	3.90	Mount Vernon.	87	41	62.2	5.98
Oswego.	90	30	56.8	3.12	Muscatine (1).	.....	5.79	.....	.....
Ottawa.	88	40	59.8	4.36	Muscatine (2).	87 ²	31	59.6	4.17
Palestine.	88	36	63.1	4.20	Osage.	.....	3.73	.....	.....
Pana.	90	44	61.1	6.83	Sac City.	86	40	57.3	2.37
Pekin.	92	31	60.5	3.47	Sioux City.	.....	1.40	.....	.....
Peoria (1).	92	35	62.6	3.92	Vinton.	81	37	59.3	4.95
Peoria (2).	.....	.....	5.82	Washington.	92	34	64.9	3.25	
Philip.	90	28	60.3	5.88	Webster City.	88	31	58.9	5.72
Pontiac.	94	26	58.2	5.50	Wesley.	88	26	56.4	1.95
Quincy.	90	33	64.9	8.25	Kansas.	.....	.....	.....	.....
Richview.	90	36	61.9	4.72	Abilene.	.....	9.05	.....	.....
Riley.	86	34	55.6	4.09	Allison.	90	40	60.5	3.34
Rockford.	85	32	57.4	6.64	Arlington.	.....	4.90	.....	.....
Rock Island Ar'l.	85	36	59.8	5.55	Atkins.	94	25	60.9	2.93
Sandwich.	92	40	61.8	3.08	Atwood.	.....	5.08	.....	.....
South Evanston.	94	31	56.2	4.02	Augusta.	88	42	65.8	4.27
Summer.	90	34	62.5	3.20	Belleview.	90	40	60.3	2.28
Sycamore.	88	32	55.9	5.17	Bendena.	.....	50.93	.....	.....
Warsaw.	.....	.....	3.36	Brookville.	98	38	67.4	.....
Waukeka.	94	28	58.9	6.40	Bucklin.	.....	1.30	.....	.....
White Hall.	86	34	62.7	10.63	Buffalo Park.	90	44	64.4	7.75
Windsor.	88	33	61.2	7.36	Bunker Hill.	98	41	65.9	7.75
Winnebago.	90	36	58.8	5.42	Burr Oak.	92	29	60.7	6.07
Indiana.	.....	.....	.....	Caquer City.	93	41	65.7	5.20	
Blue Lick.	90	36	63.1	5.55	Colby.	93	28	57.9	2.98
Butterville.	.....	39	61.7	6.43	Cold Water.	.....	3.90	.....	.....
Cannelton.	92	34	63.0	4.53	Collyer.	98	32	63.2	2.33
Columbia City.	91	32	57.3	5.95	Concordia (near).	92	26	62.0	3.80
Columbus.	89	35	61.0	4.80	Conway.	90	31	57.2	11.60
Conversville.	89	40	61.5	6.59	Cunningham.	95	39	65.8	3.46
Dana.	92	28 ²	61.8	4.53	Dorrance.	100	42	65.7	8.03
Delphi.	91	25	59.6	7.25	Dwight.	.....	.....	.....	.....
De Gonia Springs.	85	35	62.1	4.04	Elico.	92	35	64.8	6.88
Evansville.	.....	.....	5.00	Elk Falls.	87	34	67.2	5.20	
Farmland.	90	32	61.0	4.15	Fenton.	.....	.....	.....	.....
Franklin.	90	30	61.8	4.57	Fort Hays.	92	30	61.4	5.57
Huntertown.	90	36	61.6	5.50	Ft. Leavenworth (1).	97	38	67.4	8.63
Huntingburgh.	91	35	62.6	6.55	Ft. Leavenworth (2).	86	37	62.7	8.63
Huntington.	.....	.....	3.93	Grenola.	86	37	62.7	5.35	
Jeffersonville.	90	37	64.9	5.75	Groves.	.....	.....	.....	.....
Laconia.	97	34	62.8	5.46	Harrison.	.....	.....	.....	.....
La Fayette.	93	31	59.5	6.41	Hawkins.	.....	.....	.....	.....
Lagansport.	.....	.....	6.51	Hedges.	.....	.....	.....	.....
Marion.	88	31	58.0	3.20	Hill.	.....	.....	.....	.....
Maumy.	91	29	60.4	6.09	Holmes.	.....	.....	.....	.....
Mount Vernon (1).	.....	.....	4.43	Holiday.	.....	.....	.....	.....
Mount Vernon (2).	91	40	61.1	4.53	Houma.	90	48	72.5	1.51
Muncie.	91	36	61.1	7.76	Jackson Barracks.	90	42	69.7	1.53
New Providence.	94	30	62.0	4.78	Jeanerette.	.....	54	.....	0.16
Point Isabel.	90	34	61.2	9.25	Jennings.	92	47	72.5	0.08
Princeton.	91	39	64.4	4.40	La Fayette.	92	46	73.0	3.31
Richmond.	90	28	57.9	6.75	Lake Charles.	94	43	73.1	0.30
Rockville.	90	30	62.4	5.97	Lake Providence.	91	40	71.9	0.92
Rushville.	.....	.....	6.74	Liberty Hill.	93	42	71.5	1.49	
Salem.	88	38	60.5	5.29	Mandeville.	92	44	73.1	1.09
Scalesville.	94	39	65.5	4.27	Marksville.	90 ²	52	72.5	1.50
Seymour.	90	40	60.2	6.14	Maurepas.	90	46	71.0	1.06
Spiceland.	90	30	62.3	6.43	Melville.	92	45	72.2	0.55
Sunman.	89	31	60.0	5.72	Minden.	90	46	72.8	0.03
Vevay.	94	35	64.2	6.17	Monroe.	90	44	71.0	0.82
Vincennes.	88	35	60.7	4.75	Mount Airy.	94	49	73.4	0.55
Worthington.	88	40	64.6	2.90	Natchitoches.	90	40	69.9	2.02
Indian Territory.	.....	.....	.....	New Iberia.	92	51	72.9	0.26	
Caddo Creek.	88	48	67.0	.....	Point la Hache.	92	73	73.7	.....
Cantonment.	.....	1.09	.....	Port Eads.	84	59	73.4	2.40	
Eufaula.	.....	3.93	.....	Shell Beach.	88	59	74.4	.....
Fort Gibson.	85	35	66.8	5.70	Sugar Ex. station.	91	48	72.2	0.76
Fort Reno.	900	32	69.39	1.80	Trinity.	90	.....	1.50	.....
Fort Sill.	92	38	67.8	3.52	Vidalia.	94	46	74.3	0.68
Fort Supply.	100	35	66.7	2.29	Maine.	.....	.....	.....	.....
Jimtown.	45	.....	2.61	Bar Harbor.	81	38	54.4	1.79	
Lehigh.	46	51.3	.....	Belfast.	81	44	55.1	1.81	
Tulsa.	.....	3.28	.....	Calais.	89	36	56.7	1.81	

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Kansas—Cont'd.	0	0	0	Ins.	Kansas—Cont'd.	0	0	0	Ins.
McAllaster.	96	38	62.5	1.90	McAllaster.	96	32	53.1	2.54
Monument.	92	32	53.1	3.10	Monument.	92	37	58.1	2.27
Morse.	90	30	58.1	9.88	Morse.	9			

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Michigan—Cont'd.	0	0	0	In.	Minnesota—Cont'd.	0	0	0	In.
Albion (2)				4.95	Medford	85	26	54.6	1.09
Allegan				3.95	Minneapolis *	81	35	56.0	3.06
Alma	90	21	51.9	3.39	Morris	88	29	54.6	1.86
Ann Arbor	87	33	56.1	4.56	Northfield	84	30	55.9	2.66
Arbela					Ortonville				3.09
Atlantic	86	30	48.0	1.41	Pine River	79	30	53.6	1.75
Ball Mountain					Pokegama Falls	75	17	46.3	1.18
Bear Lake	80	28	48.4	3.87	Red Wing	83	33	55.9	1.85
Bellaire	88	20	51.5	3.99	Redwood Falls				2.30
Bell Branch	78	30	55.6	4.81	Rolling Green	81	31	56.8	1.10
Benton Harbor *	90	35	59.8	4.78	Tracy				1.05
Benzonia	83	30	51.0	3.94	Mississippi.				
Berlin	90	30	56.3	4.74	Aberdeen	90	33	64.5	3.38
Berrien Springs *	95	32	57.6	7.06	Agricultural College	91	40	69.2	1.55
Big Rapids	86	27	53.4	3.98	Batesville	92	39	70.4	1.00
Birmingham	91	31	56.4	4.86	Booneville	90	43	68.2	0.78
Bronson					Brookhaven	94	35	70.6	0.23
Buchanan	85	32	53.8	6.84	Canton				0.70
Calumet	80	29	46.5	2.05	Columbus	99	41	72.6	0.90
Cassopolis	89	34	57.2	5.76	Corinth	93	32	64.2	0.75
Charlevoix	86	30	51.7	3.83	Edwards	93	45	71.4	1.74
Chase	84	24	49.5	4.19	Greenville	87	45	69.5	4.03
Chelacea	88	34	56.8	3.61	Hailehurst	93	43	73.5	0.12
Clinton					Hernando	91	50	73.9	2.03
Colon					Holly Springs (1) *	88	46	69.2	1.50
Concord	89	29	55.4	4.39	Holly Springs (2) *	93	42	70.1	1.24
Courtland					Jackson	96	40	70.7	2.30
Deer Lake	84	30	54.9	2.90	Kosciusko	89	50	69.4	0.45
East Tawas	84	30	52.5	4.72	Lake	91	37	68.8	2.20
Edon	91	30	57.2	2.77	Lamar	93	43	70.8	0.90
Evert	87	22	54.2	2.22	Loch Leaven	92	47	71.7	0.79
Fitchburgh					Logtown	89	46	72.2	1.12
Flint	90	26	55.4	3.09	Louisville	94	37	70.7	0.54
Fort Brady	85	26	49.2	2.45	Macomb (1) *	90	43	70.2	0.84
Fort Mackinac	76	29	49.4	3.26	Macomb (2) *	96	40	70.6	1.02
Fort Wayne	89	31	56.7	5.49	Meridian	96	41	71.3	0.54
Fremont	80	34	55.0	3.18	Natchez	94	43	72.8	0.78
Gladwin	93	21	54.6	2.09	Okolona	98	40	71.2	0.90
Grand Rapids	89	33	56.4	3.43	Pearlton	88	55	73.7	1.36
Grape					Port Gibson	90	40	71.4	1.15
Grayling	90	25	55.5	2.85	Pontotoc	92	39	65.4	1.77
Gulliver Lake	93	23	47.1	2.69	Rienzi	92	44	70.1	1.25
Hanover	88	30	56.2	4.84	Summit	90	41	68.6	0.55
Harrisville	87	25	49.6	5.38	Water Valley	99	43	72.0	2.29
Hart	87	24	54.2	4.70	Waynesboro (1) *	89	39	69.3	0.15
Hastings	87	29	56.6	3.38	Waynesboro (2) *	94	41	68.8	0.45
Hayes					Yazoo City				1.35
Hillman	92	23	51.2	3.50	Missouri.				
Hillsdale	90	30	54.4	4.15	Booneville				
Highland Station	92	33	55.6	5.30	Conception	84	37	61.8	8.25
Hudson	90	29	56.7	5.24	Excelsior Springs *	90	38	65.0	8.93
Ionia	90	29	53.0	3.47	Fayette	88	33	63.8	9.20
Ivan	88	30	53.2	3.00	Fox Creek	86	40	62.0	3.70
Jeddo					Frankford	93	33	58.4	7.00
Kalamazoo	88	31	56.5	4.86	Glasgow	89	34	62.2	7.83
Lansing	88	31	56.8	3.86	Grand Pass	87	36	63.1	8.93
Lathrop	84	24	50.0	2.31	Harrisonville	88	40	63.6	8.23
Madison					Hermann				7.43
Manchester					Ironton	88	44	65.0	3.95
Marshall	91	30	58.8	6.68	Jefferson Barracks	88	28	58.2	3.00
May	88	30	54.4	4.74	Jerome				2.12
Mic.	90	25	53.2	3.32	Kansas City	88	37	64.8	9.03
Montague	81	29	51.0	5.23	Kidder				10.30
Mottville	90	25	57.2	3.53	Kirksville	88	36	61.8	5.70
Noble					Langdon				4.15
North Adams	89	26	54.8	4.40	Louisiana Bridge				6.30
North Aurelius					Mexico	85	42	73.8	7.94
North Marshall	85	27	54.9	4.83	Miami	90	37	63.8	9.72
Olivet	86	26	56.0	4.45	New Frankfort	88	38	67.4	14.35
Ovid	90	28	55.2	3.19	Oak Ridge	86	32	64.5	2.75
Paw Paw	88	25	55.1	4.68	Oregon	90	34	63.1	6.26
Pittsburgh	89	29	57.1	6.75	Ozark	88	26	64.3	4.31
Pontiac	84	35	58.0	4.36	Princeton	90	36	66.2	6.19
Pulaski					Saint Charles (1)	87	62.0	62.0	3.70
Rawsonville	92	30	57.9	4.40	Saint Charles (2)	87	40	64.3	4.03
Romeo	87	33	55.8	4.43	Saint Joseph				
Roscommon	90	25	51.2	3.32	Savannah				
Saint Ignace	79	27	48.5	2.93	Sedalia	90	37	63.7	7.05
Saint John's	89	30	54.9	3.08	Shelbina				10.70
Sand Beach	79	30	51.8	3.23	Springfield	89	37	64.3	5.73
Standish	91	29	54.9	7.32	Steelville	90	31	64.5	8.20
Stanton	87	27	54.3	3.23	Willow Springs	100	31	67.1	5.10
Stockbridge					Camp Poplar River	80	27	52.0	2.82
Thornville	90	34	57.7	4.48	Custer				
Traverse City (1)	91	27	50.7	3.82	Fort Assiniboine	81	26	52.2	0.41
Traverse City (2)	85	26	51.5	5.45	Fort Custer	85	29	52.6	1.59
Vandalia					Fort Keogh	85	33	53.6	2.62
Vienna					Fort Logan	78	14	48.4	2.03
Washington	86	31	53.8	4.48	Fort Maginnis	86	24	49.8	2.84
Williamston	86	34	58.0	4.34	Fort Missoula	89	32	56.6	1.48
Weldon Creek					Fort Shaw	82	26	52.8	1.50
West Branch	88	26	50.5	2.15	Galpin				2.57
Ypsilanti (1)	90	26	56.2	5.38	Glendale	80	28	52.0	1.65
Ypsilanti (2)	88	32	58.4	5.17	Powder River	84	34	53.6	1.00
Minnesota.					Sheldon	86	36	50.0	3.10
Alexandria					Virginia City	79	28	50.2	1.98
Brainard	82	35	56.8	2.34	Nebraska.				
Farmington	82	32	57.6	2.31	Anasley	95	22	58.2	1.30
Fergus Falls					Ashland	93	32	63.7	2.93
Fort Ripley					Auburn	80	33	65.7	5.91
Fort Snelling	85	29	56.1	2.09	Brownville	90	33	65.0	5.91
Grand Meadow	87	31	52.3	2.78	Craig	87	40	62.0	2.80
L. Winnibogoshish					Creighton	94	26	56.4	2.12
Le Sueur	83	40	57.2	1.48	Allaire				90
Mankato	87	34	55.9	3.47	Alaire				32

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Nebraska—Cont'd.	0	0	0	In.	Culbertson	86	34	55.4	2.43
Medford	85	26	54.6	1.09	David City	93	34	61.4	2.94
Minneapolis *	81	35	56.0	3.06	De Soto	93	34	61.4	2.94
Morris	88	29	54.6	1.86	Fairbury	89	32	59.3	7.79
Northfield	84	30	55.9	2.66	Falls City	92	33	61.9	6.55
Ortonville					Fort Niobrara	85	20	51.6	2.92
Pine River	79	30	53.6	1.75	Fort Omaha	94	35	66	

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
New York—Cont'd.	°	°	°	Ins.	Oregon—Cont'd.	°	°	°	Ins.
White Plains	84	45	60.6	2.28	Eola	84	43	57.9	Ins.
Willett's Point	88	41	60.6	2.60	Fort Klamath	90	24	50.8	1.24
North Carolina.					Grant's Pass	96	35	59.7	3.02
Asheville (1)†					La Grande	83	34	55.6	5.34
Asheville (2)†	90	30	62.6	5.47	Mount Angel	85	41	59.7	3.67
Chapel Hill	97	38	68.8	6.02	Parkers				3.16
Charleston					Siskiyou	93	34	55.8	3.63
Fayetteville†*	98	52	75.0	3.52	Tillamook†*	74	48	56.0	5.32
Goldborough†	95	44	70.9	4.70	Pennsylvania.				
Grover*g	94	44	68.7	0.30	Allegheny Arsenal	91	33	61.6	6.50
Hot Springs	88	33	63.7	0.77	Altoona	91	36	64.1	4.75
Lenoir*	89	35	63.9	6.60	Anville				6.55
Lumberton†	97	40	69.8	3.13	Aqueduct	99	43*	67.0	9.55
Mount Airy†					Bethlehem	92	34	64.0	4.30
Mount Holly†					Blue Knob	94	34*	57.8	10.52
Mount Pleasant	94	34	67.0	2.91	Brookville†				6.09
Monroe	93	41	69.0	3.11	Carlisle	96	36	63.4	4.52
Morganton†	94	37	66.0	6.17	Charlesville	90	29	58.9	11.07
Murphy					Clarion (1)†				3.84
New Bern	91	45	67.0	6.12	Clarion (2)†	86	28	56.0	4.59
Raleigh	95	46	69.0	4.55	Coatesville	94	34	66.0	5.29
Rock Spring*	96	37	67.2	0.77	Confluence†				4.46
Salisbury	93	45	71.6	3.01	Corry	92	26	55.9	2.88
Sapstone Mount*	98	34	69.6	0.77	Coudersport	90	26	59.7	7.90
Southern Pines†	98	47	75.3	5.00	Drifton†	89	33	57.8	6.80
Statesville	92	36	68.6	3.11	Doylesboro				4.82
Wadesborough†	95	38	68.9	4.18	Dyberry†	88	26	56.3	4.72
Wake Forest	93	37	68.8	3.91	Eagle's Mere	86	31	57.3	4.72
Weldon (1)†	95	39	67.4	8.48	Easton*				6.08
Weldon (2)†	98	35	66.0	8.45	Edinborough*	86	30	58.8	0.00
Ohio.					Emporium	92	25	64.5	8.04
Akron	88	33	59.1	3.34	Falls of Neshaminy	87	44	62.0	5.70
Ashland					Franklin*	86	32	57.4	2.19
Athens	89	39	59.9	2.44	Frankford Arsenal	90	36	63.2	4.43
Bangorville	90	32	57.8	4.64	Frederick				4.65
Beaumont†	92	40	61.8	0.00	Freepot†				3.19
Bellevue*	90	39	57.8	5.55	Germanmantown	88	44	63.7	5.73
Caledonia†					Girardville	89	33	60.0	6.93
Canton	90	34	59.5	2.81	Grampian Hills	90	39	59.6	11.00
Carrollton*	38	58.8	58.8	2.09	Greencastle†				4.63
Celina	91	33	61.1	4.47	Greenville	87	27	56.3	2.57
Circleville†					Hollidaysburg	94	27	63.0	7.43
Clarksville	91	32	60.6	2.95	Honesdale	83	28	56.4	5.47
Cleveland	89	33	59.4	4.16	Huntingdon	93	26	56.7	7.18
College Hill*	92	40	65.0	5.85	Johnstown†				6.15
Collinwood*					Kennett Square				1.15
Columbus Barnacks	96	33	62.1	5.56	Lancaster	91	36	62.5	4.46
Dayton	93	32	62.9	4.35	Lansdale				4.35
Demos	85	36	59.8	2.81	Le Roy*	89	32	59.4	4.41
Ellsworth					Lock No. 4†				5.84
Elyria	90	31	59.7	3.86	Mahoning†				2.95
Fostoria	92	33	61.6	6.43	Marshall's Creek	75	42	58.7	3.12
Gallipolis†					McConnellsburg	93	31	62.1	12.41
Garrettsville	87	24	55.8	2.65	Johnstown				6.15
Georgetown	93	36	62.6	2.33	Kennett Square				3.18
Granville	89	34	59.3	2.90	Lancaster	91	36	62.5	4.46
Greenville	88	32	59.7	5.57	Lansdale				3.19
Hanging Rock	90	31	59.9	4.16	Le Roy*	89	32	59.4	4.41
Hiram	85	30	57.4	2.48	Lock No. 4†				5.84
Hudson					Mahoning†				2.95
Jacksonborough	94	36	63.4	4.20	Marshall's Creek	75	42	58.7	3.12
Jefferson	87	30	56.3	3.24	McConnell'sburg	93	31	62.1	12.41
Kent	94	27	59.2	4.18	Johnstown				6.15
Kenton*	94	34	57.8	5.06	Kennett Square				3.18
Logan	93	31	60.5	2.24	Lancaster	91	36	62.5	4.46
Lordstown	89	28	59.0	2.20	Le Roy*	89	32	59.4	4.41
Mansfield					Lock No. 4†				5.84
Marietta (1)†					Mahoning†				2.95
Marietta (2)†	89	32	62.3	3.07	Marshall's Creek	75	42	58.7	3.12
McConnellsburg	91	30	62.0	3.19	McConnell'sburg	93	31	62.1	12.41
Napoleon†	93	31	60.9	5.05	Johnstown				6.15
New Alexandria	89	33	60.6	3.46	Kennett Square				3.18
New Comerstown	94	31	60.0	2.49	Lancaster	91	36	62.5	4.46
North Lewisburgh	95	34	63.0	2.75	Le Roy*	89	27	57.4	2.48
Oberlin	87	32	57.5	4.46	Lock No. 4†				5.84
O. S. University	91	32	60.6	3.45	Mahoning†				2.95
Orangeville*					Marshall's Creek	75	42	58.7	3.12
Ottawat.	90	30	56.4	2.70	McConnell'sburg	93	31	62.1	12.41
Poland*					Johnstown				6.15
Pomeroy	94	31	65.4	2.48	Kennett Square				3.18
Portsmouth (1)†					Lancaster	91	36	62.5	4.46
Portsmouth (2)†	90	36	61.8	3.27	Le Roy*	89	27	57.4	2.48
Salineville*	38	58.2	58.2	5.20	Lock No. 4†				5.84
Shanesville*	88	34	57.7	5.07	Mahoning†				2.95
Sidney	85	29	56.4	6.10	Marshall's Creek	75	42	58.7	3.12
Springborough	94	33	61.5	5.20	McConnell'sburg	93	31	62.1	12.41
Tiffin*	89	39	60.5	4.36	Johnstown				6.15
Upper Sandusky	90	33	60.2	5.54	Kennett Square				3.18
Vienna*	91	35	59.4	2.38	Lancaster	91	36	62.5	4.46
Wapakoneta	96	30	59.9	3.43	Le Roy*	89	27	57.4	2.48
Waupaca	91	26	58.4	8.22	Lock No. 4†				5.84
Wayneville					Mahoning†				2.95
Westerville					Marshall's Creek	75	42	58.7	3.12
West Milton*	91	32	59.3	3.07	McConnell'sburg	93	31	62.1	12.41
Weymouth	98	35	64.4	7.63	Johnstown				6.15
Wooster	90	30	57.8	3.61	Kennett Square				3.18
Yellow Springs	90	33	60.1	4.83	Lancaster	91	36	62.5	4.46
Youngstown	93	26	58.7	3.64	Le Roy*	89	27	57.4	2.48
Zanesville†					Lock No. 4†				5.84
Oregon.					Mahoning†				2.95
Albany†	87	43	58.6	3.05	Marshall's Creek	75	42	58.7	3.12
Ashtabula	91	47	63.8	1.90	McConnell'sburg	93	31	62.1	12.41
Bandon*	77	46	54.6	6.89	Johnstown				6.15
East Portland	87	48	54.6	4.11	Kennett Square				3.18

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
South Carolina—Con.	°	°	°	Ins.	South Carolina—Con.	°	°	°	Ins.
Beaufort†	92	51	74.0	0.45	Beaufort†	92	51	74.0	0.45
Beumont	94	71	75.1	1.17	Beaufort†	92	51	74.0	0.45
Blackville	98	44	73.3	2.06	Beaufort†	92	51	74.0	0.45
Branchville	97	41	71.6	2.06	Beaufort†	92	51	74.0	0.45
Brewer Mine	100	39	69.5	2.72	Beaufort†	92	51	74.0	0.45
Cedar Springs†	95	35	67.4	2.33	Beaufort†	92	51	74.0	0.45
Cheraw	95	40	70.9	3.79	Beaufort†	92	51	74.0	0.45
Chester									

Meteorological record of voluntary observers, &c.—Continued.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean			Max.	Min.	Mean	
Wisconsin—Cont'd.	o	o	o	Ins.	Wisconsin—Cont'd.	o	o	o	Ins.
Friendship	34	55.3	6.38		Viroqua	30	53.7	3.03	
Glasgow	34	53.4	4.70		Wauconsta	26	51.8		
Grantsburgh	83	28	3.84		Weston	34	54.1	4.02	
Greenwood	80	25	3.76		Wyoming.				
Hayward	84	33	52.6		Carter				
Lincoln	35	35	54.1	8.05	Camp Pilot Butte	83	22	52.8	1.00
Madison	82	34	55.4	3.28	Camp Sheridan	77	21	46.8	1.40
Manitowoc	76	28	54.8	4.09	Fort Bridger	20	20	21.9	
Oshkosh	85	30	55.7	3.52	Fort D. A. Russell	81	20	47.1	2.05
Phillips					Fort Laramie	58			2.35
Portage					Fort McKinney	81	29	51.6	0.45
Richland Centre	42	56.6	4.55		Fort Washakie	78	23	50.5	0.67
Summit Lake	82	32	50.4	?	Sweetwater Bridge				1.29

Precipitation (in inches and hundredths) at Amherst College, Mass., as furnished by the late Prof. E. S. Snell, from 1836 to 1882, inclusive, and by the Agricultural Experiment Station from 1883 to 1888, inclusive.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1836	4.21	3.83	3.13	1.98	2.59	3.45	6.02	0.96	2.28	3.02	3.49	5.80	40.76
1837	1.75	2.42	2.65	4.33	5.76	4.49	7.35	2.57	1.07	2.06	1.90	2.35	38.70
1838	1.67	1.67	1.69	2.30	3.63	4.90	2.27	3.95	4.12	5.77	5.77	2.93	39.81
1839	1.66	1.75	1.69	4.14	3.49	3.30	9.56	2.51	2.82	1.78	3.04	7.09	42.83
1840	3.15	2.03	3.18	3.98	1.91	4.00	3.34	6.82	5.20	5.04	4.61	3.15	47.01
1841	1.50	1.50	1.48	4.52	3.47	1.65	2.55	3.18	3.50	3.73	2.80	6.08	41.63
1842	3.02	3.78	2.39	2.92	2.40	3.18	1.95	7.42	3.23	2.84	3.73	3.19	38.05
1843	1.99	3.49	5.73	4.82	2.09	5.15	2.53	9.38	1.57	9.45	3.07	2.26	51.58
1844	3.44	2.18	4.12	0.57	5.59	3.00	3.81	4.93	1.84	6.49	2.12	2.49	40.58
1845	4.97	3.37	3.65	1.70	2.42	2.57	3.31	2.79	2.58	4.66	3.90	3.91	39.74
1846	2.74	2.55	4.35	1.54	4.33	3.10	3.25	2.44	0.47	2.09	4.96	3.10	34.92
1847	4.86	4.88	3.57	1.41	1.91	4.44	4.48	4.06	3.63	3.99	4.17	6.41	47.81
1848	2.92	2.60	3.03	1.55	6.18	2.58	4.72	1.53	2.49	3.15	3.09	5.54	39.36
1849	0.99	0.99	4.21	2.24	1.53	2.25	7.86	1.40	6.36	3.65	3.36	38.45	
1850	4.75	3.56	1.86	3.93	8.72	2.88	6.81	6.50	4.93	3.65	2.63	3.77	35.59
1851	1.66	5.08	1.28	4.43	4.07	3.69	4.31	3.03	2.05	5.43	5.30	3.17	43.50
1852	2.42	3.35	3.26	4.71	2.54	3.38	5.19	2.48	1.76	6.43	4.86	42.72	
1853	2.11	6.69	2.39	3.79	5.40	2.04	3.59	7.13	5.66	3.75	6.24	1.84	51.23
1854	2.01	4.53	3.11	8.33	1.79	5.33	0.99	5.46	2.31	7.48	2.39	45.06	
1855	5.06	2.70	1.08	3.85	1.49	5.19	6.10	2.55	0.55	10.05	4.12	5.41	48.36
1856	2.48	0.79	1.12	2.51	3.51	1.92	1.96	12.13	3.47	1.40	2.85	4.19	40.13
1857	3.55	2.41	2.7	7.68	6.82	2.66	4.98	3.14	3.04	3.88	2.07	5.31	47.66
1858	3.52	1.60	0.80	3.20	4.62	6.73	4.82	4.14	3.86	2.16	4.08	3.16	41.59
1859	4.89	3.54	6.27	2.96	4.08	6.16	2.61	6.65	4.47	1.85	2.96	5.12	41.59
1860	1.21	2.98	1.58	1.28	4.57	3.57	6.13	2.68	6.12	2.18	3.52	3.84	39.66
1861	4.34	3.26	7.65	5.65	2.69	5.23	4.10	2.75	4.53	2.17	46.93		
1862	5.25	2.84	4.30	2.28	2.33	11.69	5.12	2.98	2.12	3.28	4.76	1.91	48.86
1863	5.05	4.43	5.60	2.33	5.99	4.09	8.64	6.11	2.16	4.08	5.28	4.87	56.10
1864	2.20	1.12	2.58	2.57	2.54	1.36	0.96	4.40	2.92	2.94	6.26	4.63	34.44
1865	3.48	2.88	5.98	2.90	7.89	2.94	3.72	1.86	0.37	4.98	2.45	3.54	42.99
1866	1.36	4.62	3.16	2.03	4.48	5.66	4.02	3.96	4.71	3.35	3.47	4.51	46.15
1867	1.32	3.65	3.12	3.79	4.61	5.67	4.00	9.16	1.11	3.85	4.31	1.51	46.15
1868	3.52	1.03	2.49	4.27	7.86	2.44	3.28	5.67	10.63	1.37	4.80	1.47	49.59
1869	3.47	4.14	5.46	1.53	5.65	5.99	2.98	1.04	4.32	11.36	2.59	4.96	53.49
1870	5.87	5.25	2.71	3.71	1.72	2.73	2.53	2.83	1.75	4.49	3.28	1.84	38.70
1871	1.96	2.91	3.99	3.09	3.82	6.58	3.52	6.45	1.30	6.09	3.51	2.67	45.59
1872	1.51	1.89	2.87	2.20	3.11	3.25	7.07	5.28	6.20	3.64	4.48	3.69	44.19
1873	5.01	1.17	3.18	1.74	3.91	2.93	3.47	4.77	6.36	3.51	3.51	3.31	41.95
1874	5.46	2.19	1.35	5.02	5.22	5.06	11.58	2.69	1.82	1.85	3.54	1.17	47.96
1875	2.90	3.62	4.20	3.33	2.19	5.89	8.15	6.17	4.65	3.89	3.97	1.03	46.99
1876	2.31	5.53	7.14	3.11	3.96	3.87	4.84	0.27	3.71	1.12	2.49	3.22	41.57
1877	2.52	0.36	6.97	2.45	1.93	4.59	6.47	2.79	0.91	6.99	5.44	1.02	42.44
1878	3.58	3.67	5.75	8.55	2.36	6.00	2.16	6.97	2.82	2.05	6.02	4.02	49.39
1879	1.75	3.49	4.98	3.85	3.33	5.37	5.75	5.89	2.59	1.80	2.35	4.85	45.99
1880	4.50	3.60	2.68	2.64	1.90	4.00	6.34	2.63	2.27	2.50	2.29	35.80	
1881	4.01	1.77	4.61	3.65	2.03	3.95	1.50	2.76	2.37	4.24	4.58	6.15	42.12
1882	5.44	4.23	5.20	1.52	6.50	2.25	1.83	2.51	1.85	1.67	1.33	1.47	43.54
1883	3.24	4.03	1.70	2.18	6.20	3.99	3.69	1.57	3.17	4.31	1.80	2.99	38.87
1884	3.60	4.62	5.67	2.48	2.02	3.85	3.75	5.10	1.25	2.40	2.53	5.58	40.38
1885	3.78	3.88	0.86	3.38	3.06	3.49	2.07	3.31	0.85	3.65	5.34	5.34	42.43
1886	5.39	3.94	3.31	1.73	3.10	2.33	3.82	2.60	5.48	2.97	5.25	3.61	43.53
1887	4.57	5.05	4.05	2.98	1.53	5.09	8.93	7.75	1.22	2.10	3.35	4.11	33.82
1888	3.87	4.25	6.23	3.32	4.29	5.40	3.63	5.84	11.52	5.60	4.50	3.49	33.82
Means.	3.34	3.18	3.45	3.19	3.88	3.76	4.45	4.42	3.46	3.89	3.84	3.60	44.46

Precipitation (in inches and hundredths) observed by assistant surgeons, U. S. Army, and Signal Service observers at Fort Sill, Ind. T.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1870	0.03*	0.03*	1.30*	3.72	0.00	4.64	4.55	3.03	7.24	5.56	0.14	2.72	32.96
1871	0.00	1.63	4.52	0.77	5.59	3.62	0.19</td						

Table of miscellaneous meteorological data for May, 1889—Signal Service observations.

Stations and districts.	Elevation above sea level, feet.	Pressure, in inches.			Temperature of air, in degrees Fahrenheit.										Wind.			Temperature data since opening of station.										
		Mean actual.	Mean reduced.	Monthly range.	Monthly mean.			Maximum.	Mean maximum.	Minimum.	Mean minimum.	Greatest daily range.	Least daily range.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.	Total movement, miles.	Prevailing direction.	Maximum velocity.	Cloudless days.	Partly cloudy days.	Cloudy days.	Days with rainfall.	8 a.m. Average cloudiness, tenths.	Length of record, years.	Absolute maximum.	Absolute minimum.	Year.
		Mean actual.	Mean reduced.	Monthly range.	Departure from normal.	Maximum.	Mean maximum.	Minimum.	Mean minimum.	Greatest daily range.	Least daily range.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.	Departure from normal precipitation.	Total movement, miles per hour.	Prevailing direction.	Miles per hour.	Cloudless days.	Partly cloudy days.	Cloudy days.	Days with rainfall.	8 a.m. Average cloudiness, tenths.	Length of record, years.	Absolute maximum.	Absolute minimum.	Year.	
<i>New England.</i>					56.2 + 2.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	55.2 + 0.2	
Eastport	53	29.89	29.95 0.89	49.4 + 2.4	70	56.6	37	42.2	28	7	42.8	82.8	2.29 + 2.04	5	244	SW.	28	*	*	9	12	10	9.3-5.3-5	17	80	1877	29	1882
Portland	99	29.83	29.94 0.81	55.2 + 0.2	92	62.9	37	47.5	38	4	46.6	76.6	2.05 + 0.50	5	506	S.	25	W.	10	3	24	14	9.4-4.4-2	18	94	1880	32	1888
Manchester	247	29.70	29.95 0.72	60.0 +	94	71.7	36	45.2	41	6	47.2	67.5	2.29 + 2.09	5	797	SE.	25	W.	10	6	18	7	12.5-0.5-6	3	94	1889	28	1888
Northfield	871	28.99	29.92 0.69	55.9 +	90	67.4	31	44.4	41	5	46.0	68.9	2.48 + 2.08	5	455	S.	45	N.	25	6	12	8	10.5-9.5-5	3	90	1889	24	1888
Boston †	125	29.83	29.96 0.73	60.3 + 4.3	91	69.5	41	51.1	36	6	52.0	74.4	4.78 + 1.52	7	704	SW.	36	W.	10	9	14	8	12.4-7.4-7	19	97	1880	31	1882
Nantucket	14	29.97	29.98 0.75	54.2 +	69	60.3	40	48.2	19	1	51.2	89.2	2.26 + 2.06	7	163	SW.	45	NE.	26	13	10	8	6.3-1.4-0	3	77	1887	37	1888
Wood's Hole	22	29.96	29.98 0.77	55.0 +	72	61.5	40	48.6	24	6	50.0	87.1	5.33 + 2.37	8	846	SW.	40	SE.	26	10	14	7	9.4-0.3-2	12	81	1875	34	1873
Vineyard Haven	26	29.96	29.99 0.74	53.8 + 0.8	70	59.4	40	48.1	22	5	50.1	88.2	3.21 + 0.87	9	837	SE.	50	NE.	26	11	12	8	10.3-3.5-9	3	85	1887	23	1888
Block Island	22	29.96	29.99 0.74	55.2 + 2.2	74	65.3	35	47.1	31	10	54.9	91.8	4.59 + 1.84	8	882	SW.	40	N.	10	12	13	8	10.3-6.3-5	9	78	1881	35	1888
Narragansett Pier	22	29.96	29.99 0.74	55.2 + 2.2	74	65.3	35	47.1	31	10	54.9	91.8	4.59 + 1.84	8	882	SW.	40	N.	10	12	13	8	84	1886	34	*		
New Haven	107	29.86	29.97 0.73	59.6 + 2.6	91	68.9	37	50.4	36	7	51.1	78.9	3.81 + 0.33	4	775	*	40	N.	10	12	13	6	9.4-9.4-8	17	91	1889	30	1882
New London	47	29.91	29.96 0.74	58.7 + 2.7	82	66.1	40	51.3	27	6	52.8	81.8	3.84 + 0.33	4	990	*	30	SE.	31	10	15	6	10.5-0.4-8	16	89	1881	32	*
<i>Mid-Atlantic States.</i>				54.1 + 0.7																								
Albany	85	29.86	29.95 0.70	62.2 + 1.2	92	73.0	36	51.4	37	8	52.1	74.0	3.32 + 1.45	5	632	S.	36	SE.	31	7	14	10	12.6-1.5-1	16	92	*	29	*
New York City	155	29.78	29.95 0.72	62.0 + 2.0	87	70.9	40	53.1	29	8	51.8	76.0	3.25 + 0.22	5	278	S.	35	NW.	10	7	16	8	11.4-3.5-1	18	94	1880	34	*
Harrisburg	301	29.60	29.95 0.62	62.6 +	90	71.9	40	53.4	35	5	51.6	72.9	5.31 + 0.16	5	918	W.	36	NW.	10	4	19	8	12.4-7.5-3	1	90	1889	40	1889
Philadelphia	117	29.86	29.98 0.73	64.7 + 1.7	90	74.1	43	55.3	33	4	53.0	74.4	4.32 + 1.59	5	7314	DW.	60	NW.	8	11	12	12	16.4-2.6-3	19	96	1880	36	1880
Atlantic City	53	29.93	29.98 0.73	59.0 + 1.0	89	65.5	41	52.5	33	4	53.0	84.4	2.62 + 0.05	5	7900	*	50	NW.	10	12	10	9	13.3-7.4-8	16	89	*	33	*
Baltimore	76	29.89	29.98 0.65	65.8 + 1.8	93	75.0	43	56.7	30	6	53.2	67.6	6.82 + 3.59	4	198	*	35	NW.	10	8	15	8	16.5-1.5-5	17	95	1881	34	1876
Washington City	112	29.85	29.97 0.62	64.6 + 0.4	93	74.8	39	54.5	40	6	54.6	73.2	10.69 + 7.21	4	906	DW.	50	NW.	10	12	11	8	16.4-4.4-8	19	96	1880	41	1876
Cape Henry	12	29.93	29.99 0.66	64.8 + 0.2	97	72.2	47	57.5	35	5	54.8	74.0	4.54 + 0.64	4	454	*	40	N.	10	12	13	8	14.9-4.9-9	17	94	1887	37	1876
Lynchburg	685	29.30	29.99 0.66	64.0 + 1.0	95	75.1	35	53.3	49	4	54.6	74.0	7.14 + 3.08	4	606	*	30	NW.	22	13	14	14	14.9-4.9-5	17	94	1887	37	1876
Norfolk	69	29.92	29.99 0.59	68.1 + 1.1	93	77.7	46	58.5	33	9	56.4	73.8	4.55 + 0.57	5	711	NW.	50	W.	22	12	10	9	13.4-2.5-8	19	98	1880	35	1876
<i>S. Atlantic States.</i>				71.4 - 0.7																								
Charlotte	808	29.16	30.00 0.55	70.4 + 1.4	95	82.9	38	57.8	36	14	55.3	64.1	2.75 + 1.61	5	3579	*	34	SE.	30	18	8	5	4.2-6.3-2	11	95	1889	35	1889
Hatteras	11	29.99	30.01 0.55	68.4 + 2.4	84	74.3	52	62.5	20	6	60.4	78.8	6.03 + 1.85	5	9458	S.	50	NW.	22	16	11	10	13.3-2.3-7	9	88	1881	42	1882
Kitty Hawk, d.				68.5 + 2.5																								
Raleigh	375	29.59	29.98 0.56	68.2 +	94	78.4	40	65.6	36	5	57.1	69.0	5.30 + 0.57	5	2524	N.	27	NW.	22	4	12	5	12.3-1.2-7	3	94	1889	40	1889
Southport				70.0 + 0.8																								
Wilmington	52	29.93	29.99 0.51	70.9 + 0.9	97	80.4	46	61.4	34	3	60.7	75.0	4.24 + 0.07	5	5440	SW.	30	S.	30	17	9	5	9.3-2.3-8	19	97	1889	35	1876
Charleston	52	29.90	30.01 0.48	70.9 + 0.6	96	82.9	44	64.4	29	10	59.6	98.9	7.36 + 3.27	5	7006	S.	36	*	22	8	1	5	1.7-3.1	17	96	1889	47	1876
Columbia				73.0 + 0.8																								
Augusta	183	29.84	30.03 0.59	72.6 + 0.4	99	86.5	45	58.8	41	13	57.9	64.5	1.02 + 2.44	2	882	W.	20	W.	14	18	10	8	12.6-1.5-1	16	100	1878	42	1877
Savannah	87	29.93	30.02 0.59	73.6 + 0.4	96	84.2	50	63.0	29	10	56.0	69.9	0.35 + 2.71	2	604	DW.	25	W.	19	10	12	10	2.2-2.8-5	19	98	1878	48	1877
Jacksonville	43	30.00	30.05 0.51	74.6 + 0.4	94	85.9	50	63.2	32	12	63.7	74.0	0.51 + 2.85	2	4266	W.	24	*	21	7	3	3	1.1-2.3	18	98	1878	48	1877
<i>Florida Peninsula.</i>				75.4 - 2.6</b																								

Table of miscellaneous meteorological data for May, 1889—Signal Service observations—Continued.

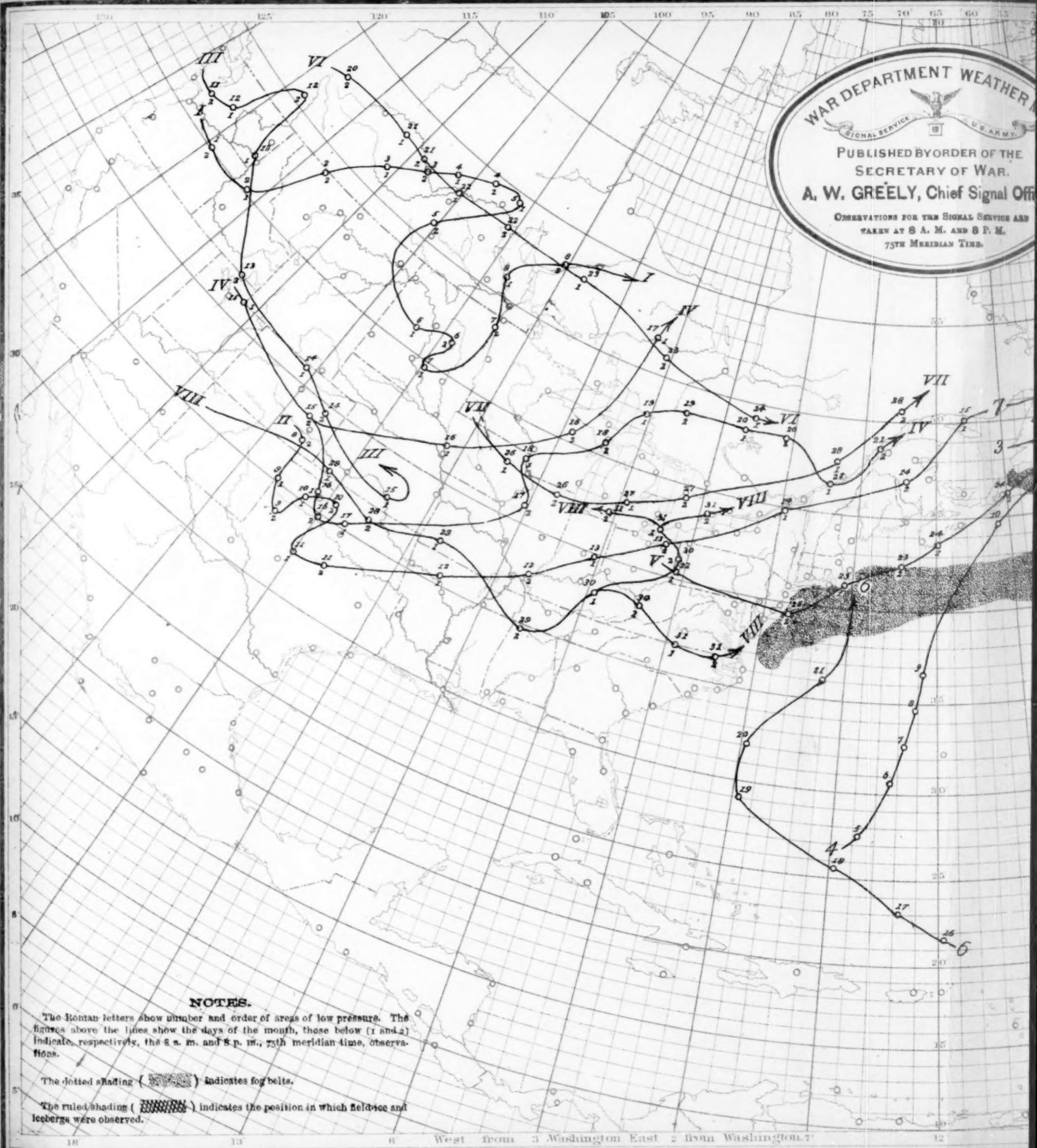
Stations and districts.	Elevation above sea-level, feet.	Pressure, in inches.		Temperature of air, in degrees Fahrenheit.												Wind.				Temperature data since opening of station.											
		Mean actual.		Temperature of air, in degrees Fahrenheit.			Mean minimum.			Greatest daily range, least daily range.			Mean temperature of the dew-point.			Wind.			Days with rainfall.												
		Mean reduced.	Monthly range.	Monthly mean.	Departure from normal.	Maximum.	Mean maximum.	Minimum.	Mean minimum.	Range.	Mean relative humidity, per cent.	Precipitation, in inches.	Total movement, miles.	Maximum velocity.	Cloudless days.	Partly cloudy days.	Cloudy days.	Length of record, years.	Absolute maximum.	Absolute minimum.	Year.										
<i>Ex. northwest--Con.</i>																															
Fort Buford	1,900	27.90	29.92	1.24	51.2	4.8	76	62.7	27	39.6	37	1	35.2	60.6	2.69	0.89	7,220	NW.	36	se.	3	9	19	126.5-57.4	11	95	1880	20185			
Fort Yates	.....	.....	.....	.....	56.2	2.1	85	68.6	20	43.8	50	3	.....	.....	3.29	1.89	.....	NW.	.....	.....	.....	9	14	9	6	96	1886	20189	
<i>Upper Miss. Valley.</i>					50.6	2.7	.....	.....	.....	.....	.....	.....	4.27	4.27	0.12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Saint Paul	831	29.03	29.93	0.94	56.0	-4.0	84	66.2	33	45.9	33	5	42.0	63.2	2.86	0.46	5,632	NW.	38	se.	7	7	18	6	105.1-54.5	17	94	1874	241875		
La Crosse	744	29.16	29.90	0.70	57.0	-4.0	83	66.9	34	47.2	37	7	42.4	62.6	2.30	0.39	5,919	S.	39	sw.	6	115.6-64.9	17	96	1874	291875
Davenport	615	29.20	29.96	0.61	60.0	-2.0	82	68.7	37	51.3	30	4	47.5	67.4	6.36	+1.95	7,017	S.	36	90	1887	291875	
Des Moines	869	29.01	29.93	0.58	60.9	-2.1	81	71.3	34	50.5	33	6	44.8	60.6	4.84	0.45	7,311	N.	46	n.	8	10	18	13	105.6-44.1	11	94	1886	261886		
Dubuque	665	29.23	29.94	0.64	59.4	-1.6	85	69.2	36	49.7	31	5	51.2	77.0	4.00	+0.05	4,257	S.	23	.....	8	14	13	13	125.5-61.6	16	94	1874	261875	
Keokuk	618	29.31	29.96	0.62	61.8	-2.2	82	70.9	38	52.5	29	6	48.8	66.8	5.72	+1.65	7,872	S.	42	s.	15	6	19	16	114.8-38.9	15	92	1874	291875		
Cairo	359	29.61	30.00	0.51	65.8	-2.2	82	78.5	41	56.5	33	7	50.4	62.2	1.91	0.26	4,690	S.	36	.....	30	15	7	9	73.4-3.6	8	92	1874	371875	
Springfield, Ill.	644	29.29	29.95	0.54	60.5	-3.2	88	70.1	35	51.6	32	3	49.2	69.0	6.64	+1.48	7,951	S.	36	s.	17	4	10	17	116.2-62.9	10	88	*	341863		
Saint Louis	571	29.35	29.99	0.53	63.6	-2.1	90	73.2	42	54.4	34	5	50.3	66.0	3.80	+0.23	8,744	S.	38	*	10	11	10	11	114.6-4.4	19	93	1874	321875		
<i>Missouri Valley.</i>					52.8	-1.8	.....	.....	.....	.....	.....	.....	5.83	5.83	-0.84	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kansas City	947	28.96	29.96	0.72	63.3	-2.1	85	72.5	39	54.1	30	6	54.1	74.6	8.98	.....	7,870	S.	42	s.	7	14	12	12	16.5-5.4	1	85	1889	391889	
Springfield, Mo.	1,350	28.56	29.98	0.58	62.8	-2.1	86	73.1	37	52.6	29	12	52.6	73.4	4.84	+2.74	8,074	S.	36	*	5	9	15	7	104.9-3.6	4	89	1883	341888		
Leavenworth	842	29.07	29.95	0.78	63.8	-2.2	89	73.7	37	53.9	32	6	51.4	69.0	9.90	+4.78	6,317	*	36	s.	5	9	18	4	14.5-7.4	9	94	1875	311875		
Topeka	.....	.....	.....	.....	63.0	.....	84	74.9	30	51.1	34	11	.....	.....	6.08	.....	.....	S.	.....	.....	5	17	9	13	.....	2	89	1889	301889
Omaha	1,113	28.77	29.94	0.99	62.5	-0.5	90	72.5	37	52.5	30	7	43.4	55.2	2.67	+2.05	7,409	N.	40	s.	6	9	12	10	115.6-5.5	17	93	1887	261887		
Crete	.....	.....	.....	.....	61.0	.....	85	72.4	32	49.7	35	10	.....	.....	4.46	.....	.....	S.	.....	.....	7	16	8	14	.....	2	89	1889	301889
Valentine	2,613	27.23	29.95	1.25	54.6	-2.1	84	66.7	23	42.5	42	7	43.6	70.2	2.05	+3.02	7,905	*	48	w.	7	13	5	13	124.2-5.2	4	95	1886	221887		
Fort Sully	1,600	28.23	29.92	1.41	54.4	-2.6	85	66.7	25	44.0	37	5	41.1	62.1	2.90	+0.50	5,115	NW.	36	*	6	9	11	11	84.7-5.1	12	101	1874	151883		
Huron	1,307	25.54	29.93	1.48	54.8	-2.2	80	67.5	22	42.0	39	7	40.4	60.2	3.04	+0.53	8,219	NW.	48	se.	6	5	10	14	104.1-4.9	8	96	1886	221889		
Yankton	1,234	28.63	29.93	1.39	54.9	-2.1	85	67.5	20	47.4	39	14	40.0	54.4	2.72	+2.79	6,584	NW.	56	s.	6	10	15	6	114.1-5.3	17	95	1886	241875		
<i>Northern Slope.</i>					51.1	-0.8	.....	.....	.....	.....	.....	.....	2.44	2.44	-1.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Assiniboin	2,720	27.10	29.90	0.90	52.0	-2.0	87	63.5	29	40.6	42	4	32.8	56.6	3.15	+1.88	8,998	NW.	50	w.	4	7	12	12	126.2-4.5	9	95	1886	181886		
Fort Custer	3,040	26.79	29.92	0.52	52.6	-3.4	85	65.4	29	40.7	45	3	36.8	60.0	1.59	+0.66	8,278	N.	48	w.	27	10	11	11	116.5-5.3	10	96	1886	141886		
Fort Maginnis	4,340	25.51	29.90	0.66	52.6	-4.2	84	65.4	29	40.7	45	3	36.8	60.0	1.59	+0.66	8,278	S.	48	.....	11	6	14	14	145.2-5.5	7	92	1886	141886	
Helena	4,059	25.76	29.87	0.83	53.2	-1.2	80	64.0	31	42.4	40	9	33.6	54.4	2.20	+0.85	4,473	S.	36	NW.	25	17	5	9	124.6-4.5	10	89	1886	201886		
Rapid City	3,250	26.56	29.93	1.10	53.2	-2.5	82	62.8	31	41.5	39	6	33.3	53.4	2.19	.....	7,332	W.	36	*	25	17	3	16	134.7-6.7	5	89	1882	201882	
Cheyenne	6,105	23.95	29.93	0.87	49.5	-2.5	78	61.2	24	37.8	40	2	31.6	59.0	2.85	+0.69	5,315	NW.	52	w.	7	4	8	19	135.2-7.2	17	88	1874	231888		
Fort Laramie	.....	.....	.....	.....	54.2	.....	83	68.6	26	39.8	44	10	.....	.....	2.20	+0.20	8,862	S.	44	s.	6	7	13	11	124.5-5.5	15	98	1886	221887
Fort McKinney	.....	.....	.....	.....	54.6	0.0	77	66.0	30	35.5	43	4	33.4	54.2	0.79	.....	8,607	N.	60	sw.	4	7	12	12	125.6-5.5	2	77	1889	291888
Fort Washakie	5,350	24.40	29.93	0.56	50.2	.....	81	63.5	27	37.0	44	9	32	55.5	0.55	.....	3,985	sw.	47	w.	21	11	12	8	153.8-9.4	4	81	1889	301888
North Platte	2,841	27.03	29.95	1.23	56.3	-3.7	89	69.1	25	43.5	43	6	40.4	62.3	2.71	+0.41	8,054	N.	38	sw.	7	4	17	10	124.8-6.2	15	94	1880	251889		
<i>Middle Slope.</i>					51.1	-0.8	.....	.....	.....	.....	.....	.....	2.24	2.24	-1.53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Colorado Springs	5,261	24.72	29.90	0.90	55.5	-1.5	83	67.0	32	44.0	35	9	34.0	55.7	3.44	+0.66	4,618	*	45	NW.	6	7	16	8	94.9-6.1	2	79	1889	31*		
Pueblo	4,724	25.22	29.90	0.59	59.5	-2.1	87	72.8	33	40.7	42	6	32.4	55.5	4.10	+0.40	6,409	e.	59	sw.	6	4	21	21	95.3-6.9	1	87	1889	331889		
Concordia	1,384	28.47	29.91	1.01	62.4	-1.6	86	72.9	34	51.8	33	5	49.6	67.2	5.65	+1.31	7,338	s.	50	s.	6	15	10	6	143.6-3.5	5	95	1887	311885		
Dodge City	2,523	27.32	29.94	1.04	63.9	-0.3	84	75.9	35	51.5	35	7	46.4	60.2	1.54	+0.35	10,355	N.	54	s.	6	7	17	7	124.5-5.5	15	98	1880	321884		
Fort Reno	.....	.....	.....	.....	66.0	.....	88	75.9	34	52.7	35	5	40.9	59.1	2.09	+0.27	8,862	s.	44	s.	6	10	13	8	115.3-4.7	7	101	1886	341889
Fort Supply	.....	.....	.....	.....	68.4	0.0	81	81.0	32	55.7	42	11	.....	.....	1.97	+2.70	8,700	s.	60	se.	6	13	12	4	100	88	341889		
Fort Elliott	2,650	27.20	29.90	0.90	66.8	-0.8	85	79.1	35	52.5	39	8	47.4	57.6	2.24	+0.10	12,244	se.	60	se.	10	11	13	7	74.5-3.4	10	98	1889	35*		
<i>Southern Slope.</i>					56.8	-0.8	.....	.....	.....	.....	.....	.....	2.24	2.24	-0.51	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Sill	1,200	28.71	29.94	0.80	68.2	-2.8	82	78.5	38	57.9	34	5	56.5	71.9	3.63	+0.84	9,399	S.	48	s.	15	9	7	13	134.4-3.5	12	104	1886	361889		
Abilene	1,748	28.16	29.95	0.70	71.5	-4.5	84	81.6	42	61.4	30	7	56.8	65.9	2.93	+0.29	10,064	S.	58	s.	15	13	13	5	64.0-4.4	12	104	1886	421889		
Fort Stanton	6,154	23.94	29.77	0.53	59.0	0.0	83	69.5	23	43.3	49	23	.....	.....	0.00	-0.54	8,248	sw.	16	12	17	2	22.4-3.4	5	84	1885	291887		
<i>Southern Plains.</i>					67.3	+1.8	.....	.....	.....	.....	.....	.....	0.02	0.02															

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. * Two or more directions, dates, or years. † Precipitation measured at the Boston Water Works; taken the place of the measurement at the Signal Office.

Chart I. Tracks of Areas of Low Pressure

7, 1889

Absolute minimum.



NOTES.

The italicized letters show number and order of areas of low pressure. The figures above the lines show the days of the month, those below (1 and 2) indicate, respectively, the a. m. and p. m., 93rd meridian time, observations.

The dotted shading () indicates fog belts.

The ruled shading () indicates the position in which field-ice and icebergs were observed.

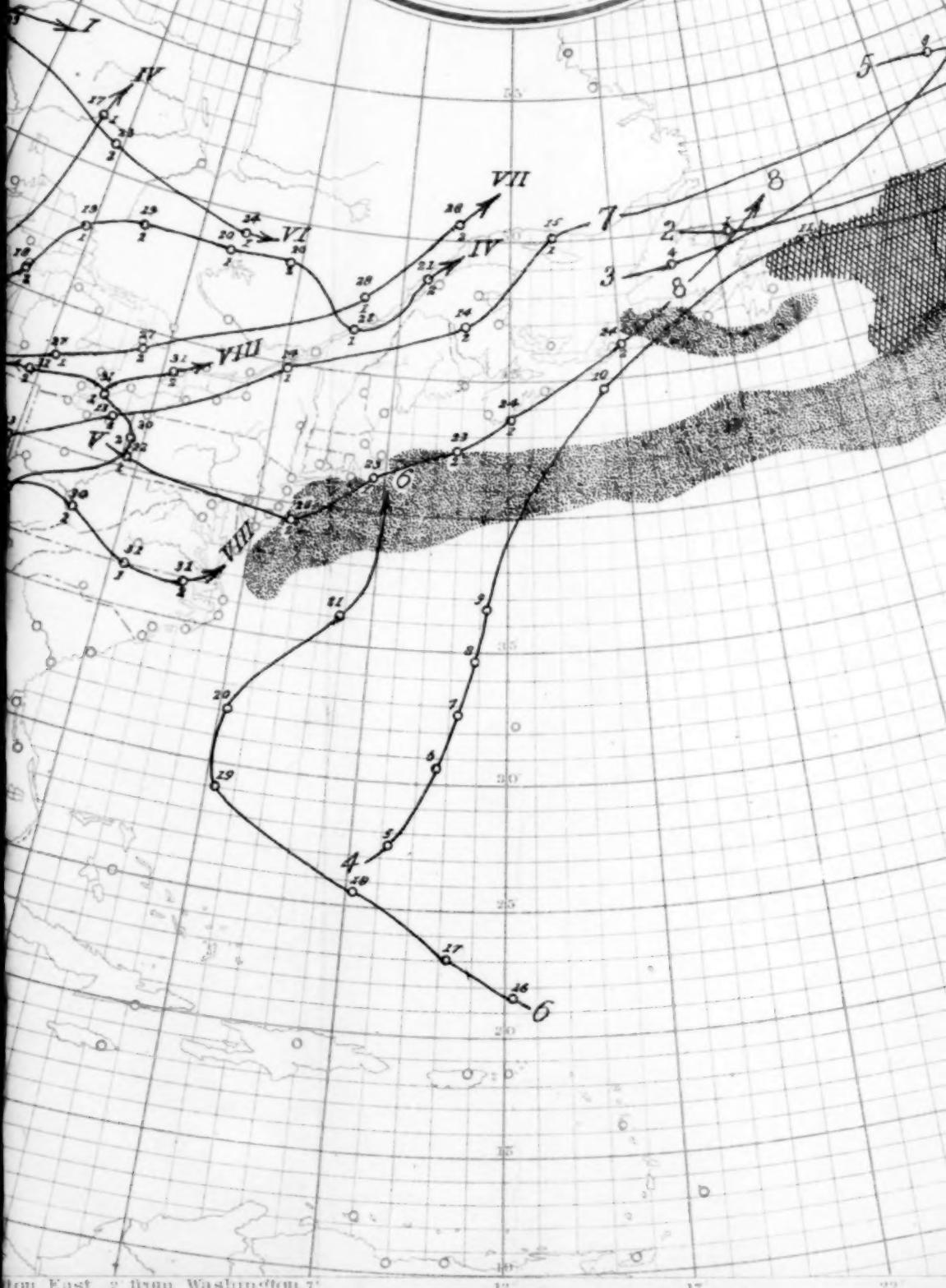
Chart I. Tracks of Areas of Low Pressure. May, 1889.

WAR DEPARTMENT WEATHER MAP
SIGNAL SERVICE
U.S. ARMY

PUBLISHED BY ORDER OF THE
SECRETARY OF WAR.

A. W. GREELY, Chief Signal Officer.

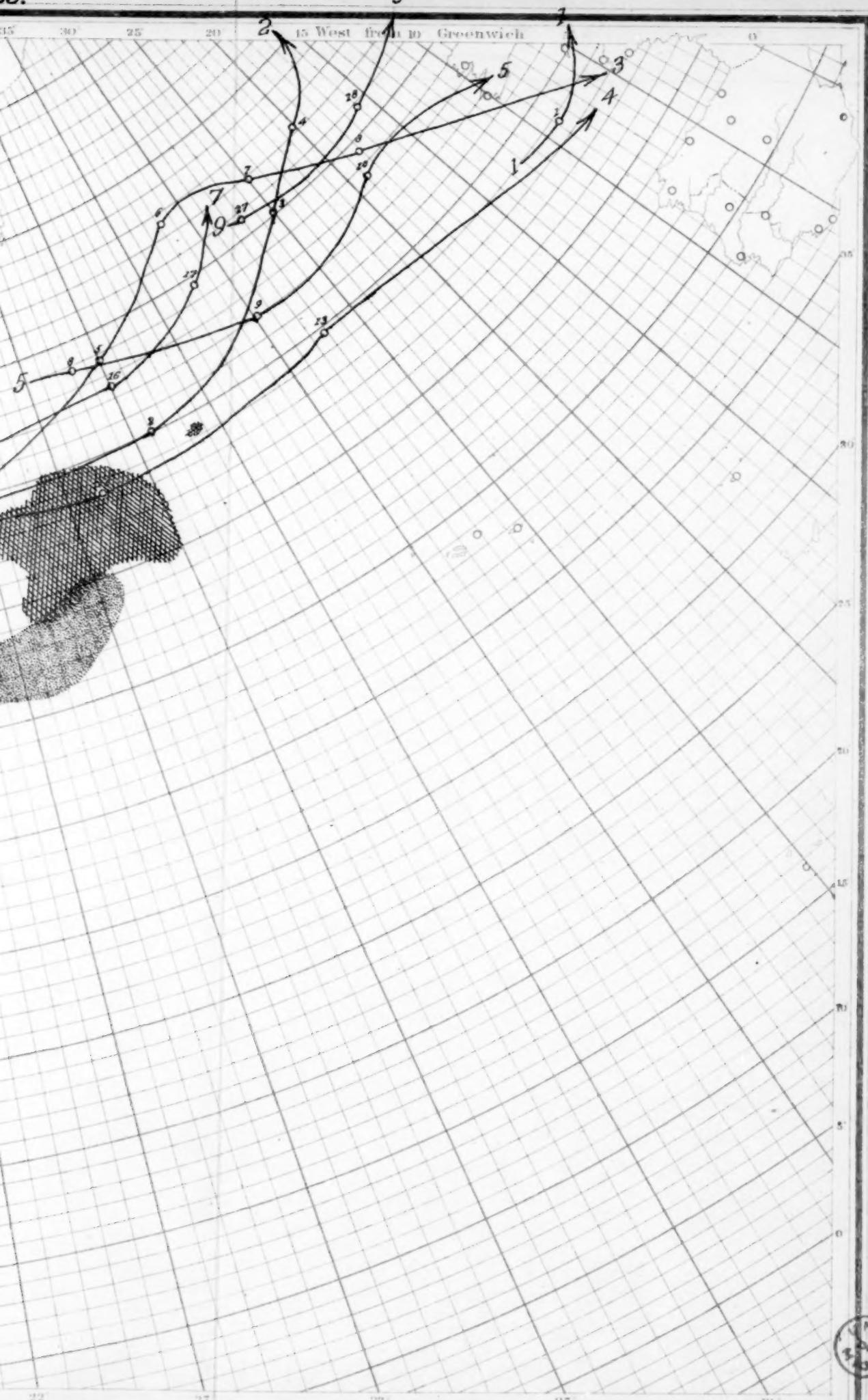
OBSERVATIONS FOR THE SIGNAL SERVICE ARE
TAKEN AT 8 A. M. AND 8 P. M.
75TH MERIDIAN TIME.



39.

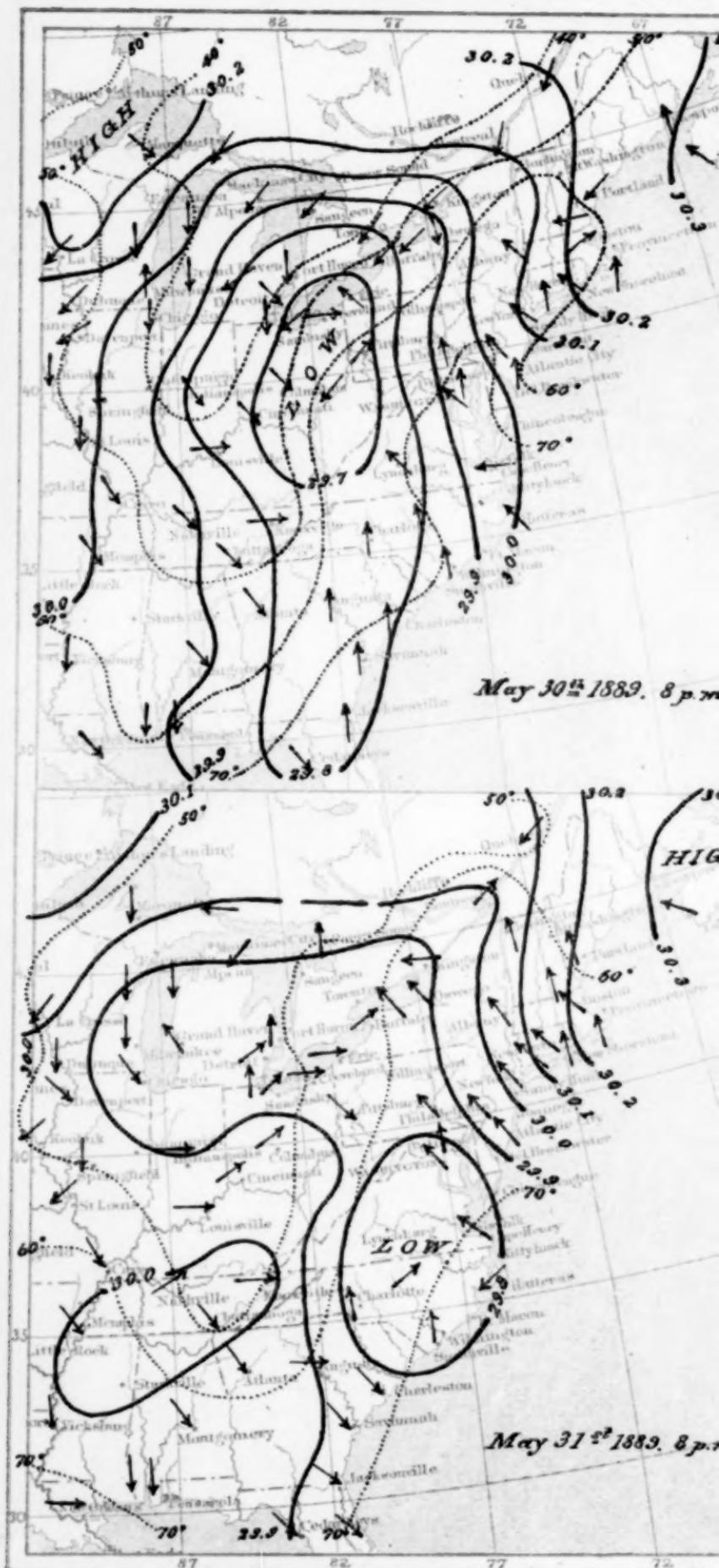
9

15 West from 10 Greenwich



Signal Office Lith.

Chart IV. showing barometric pressure, tempera



temperature, and wind direction attending storm of May 30 and 31, 1889.

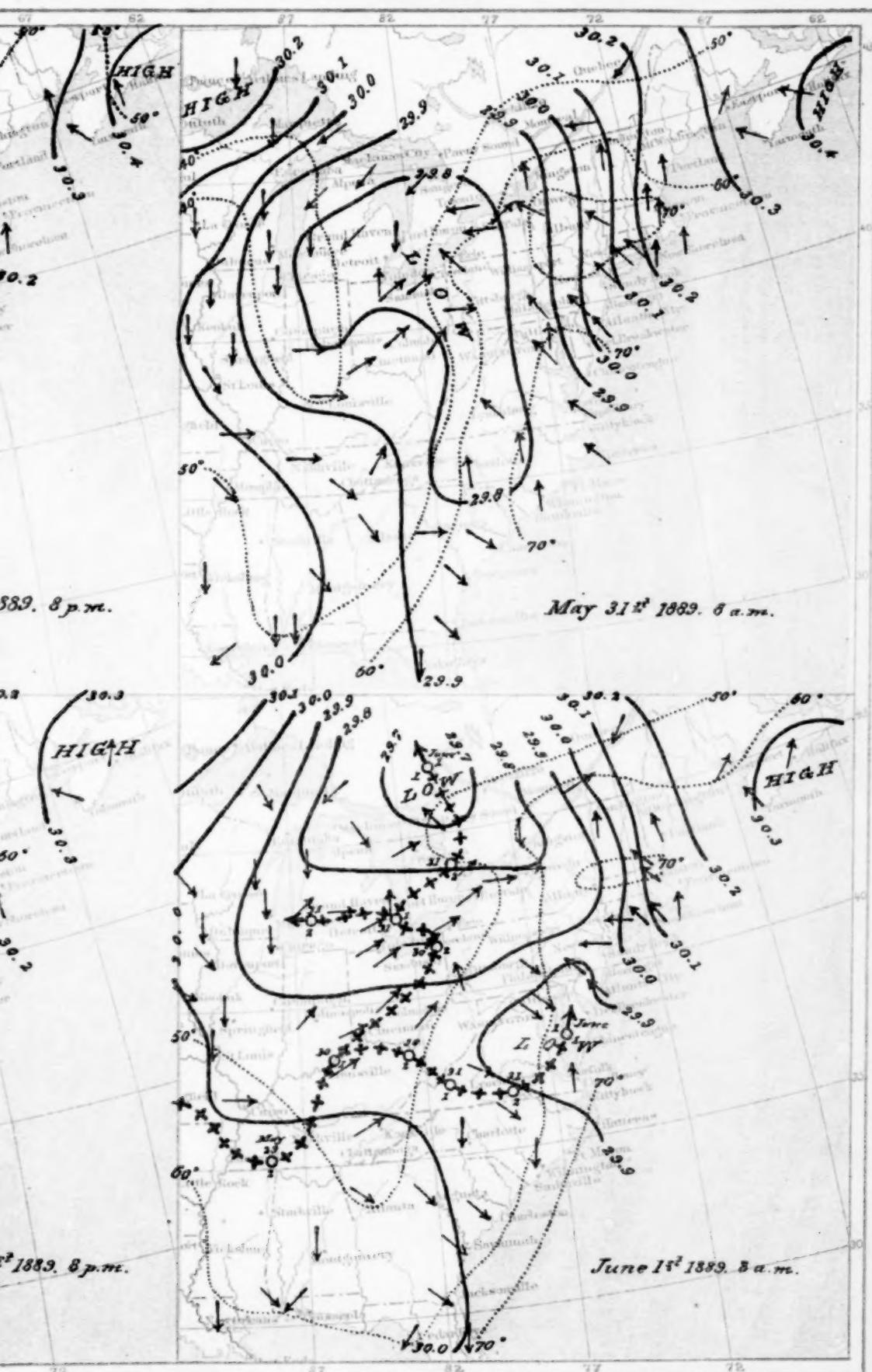


Chart VII.

Map of Johnstown Drainage Area.

Enclosed Area is the area draining into reservoir.

Approximate Scale of Miles $\frac{1}{4}$ inch = 1 mile.

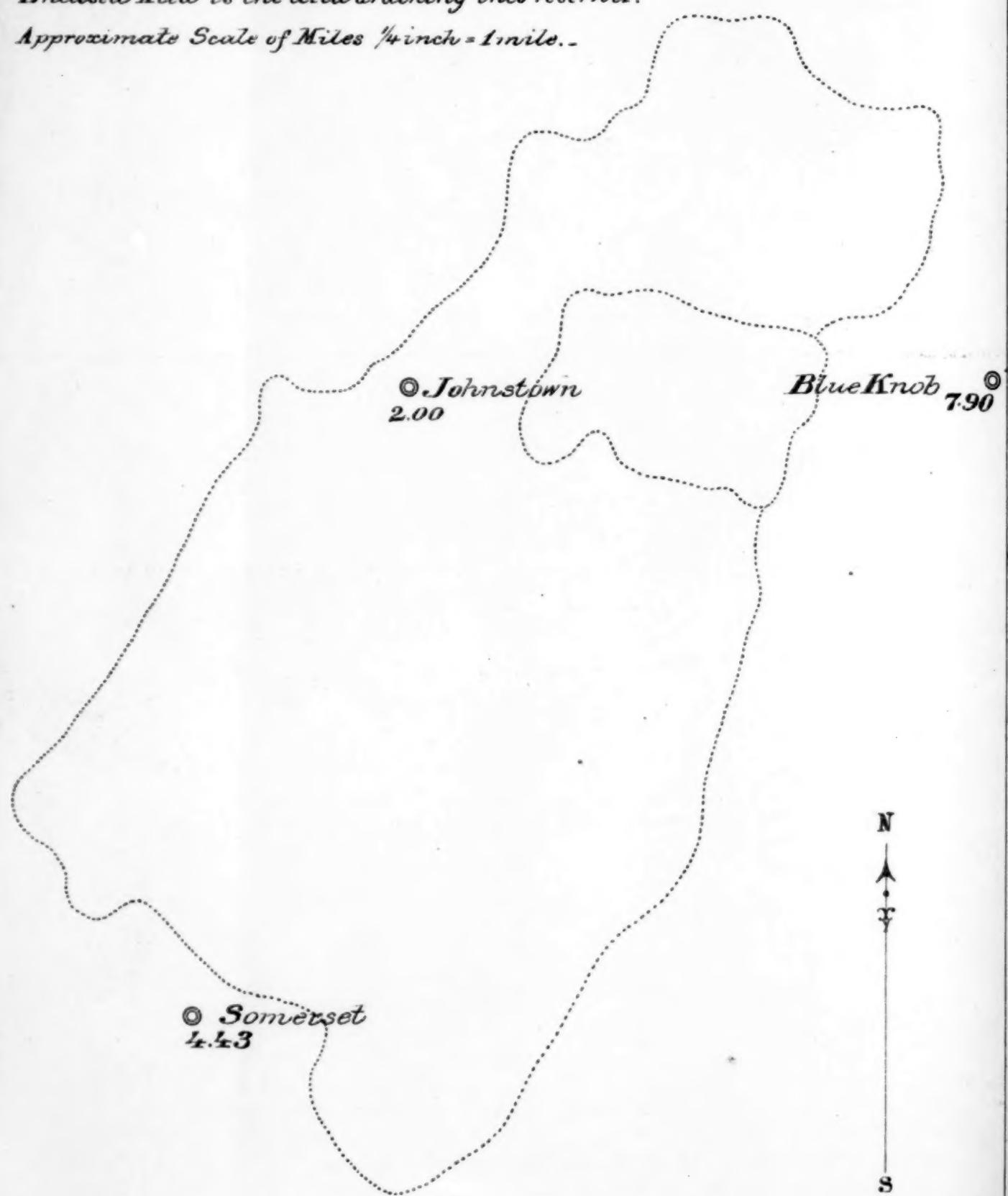


Chart II. Isobars, Isotherms, and Winds. May, 1889.

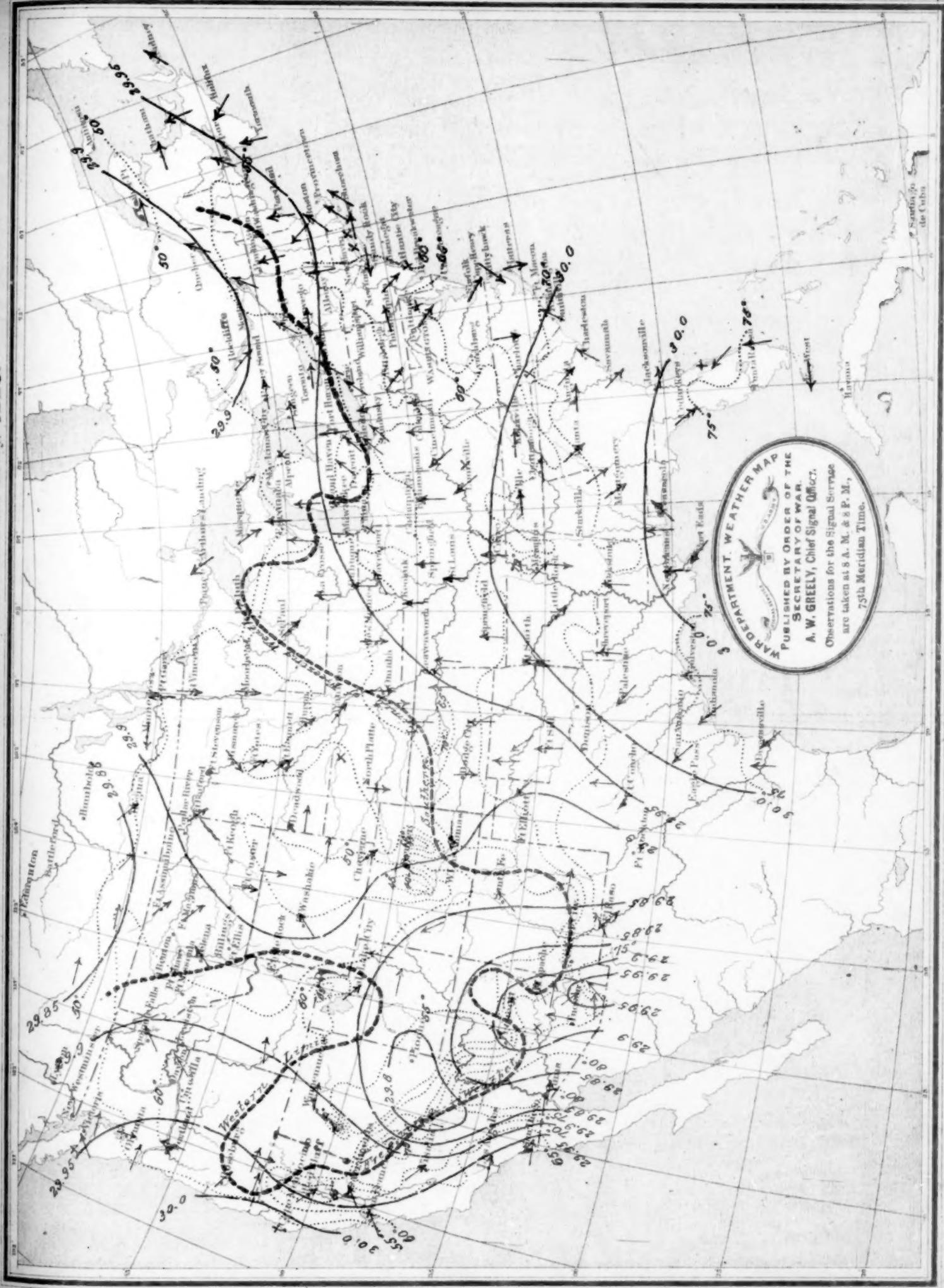


Chart VI.

Broken Black Lines show times
of commencement of rain...

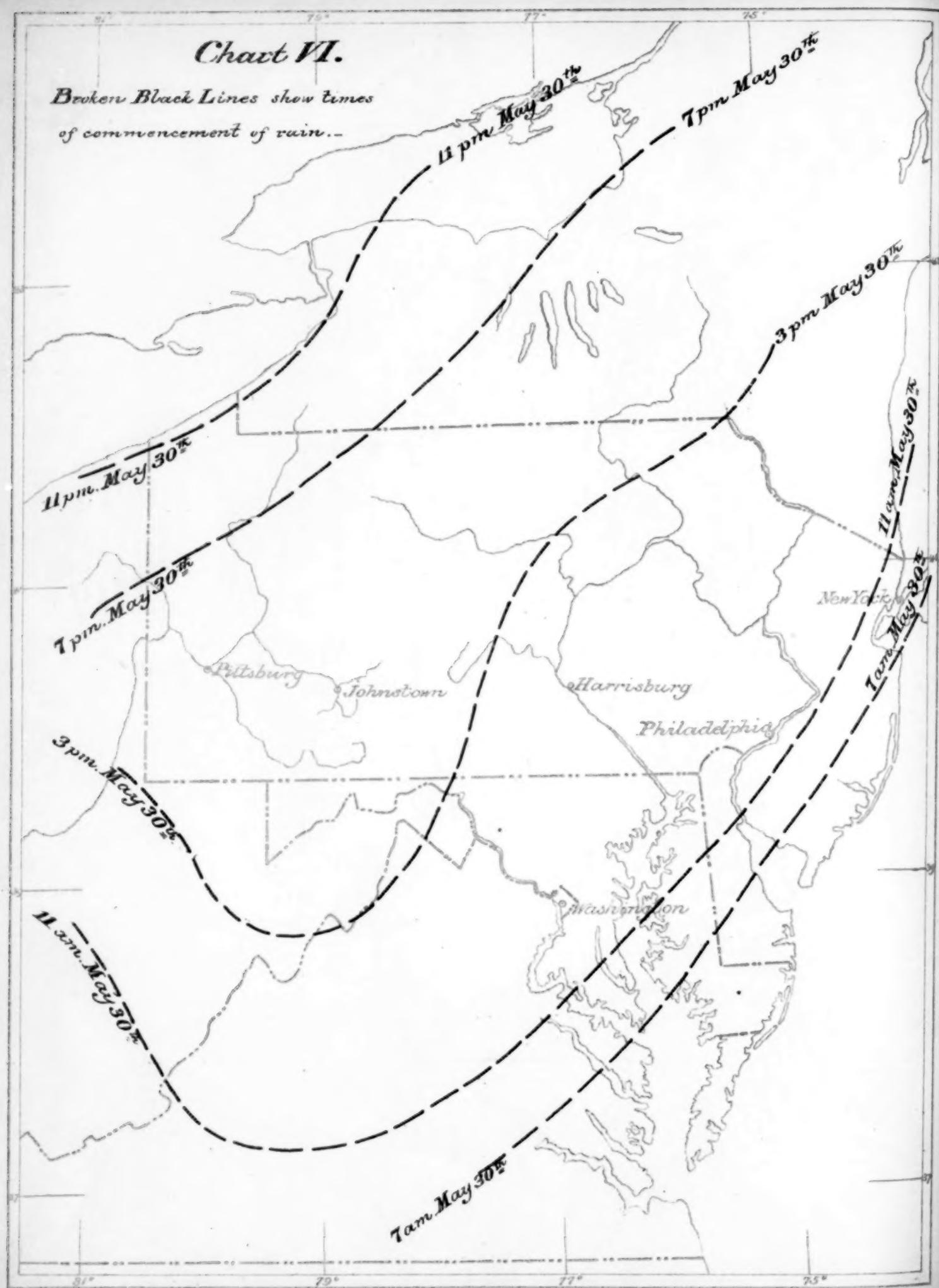


Chart III. Precipitation, May, 1889.

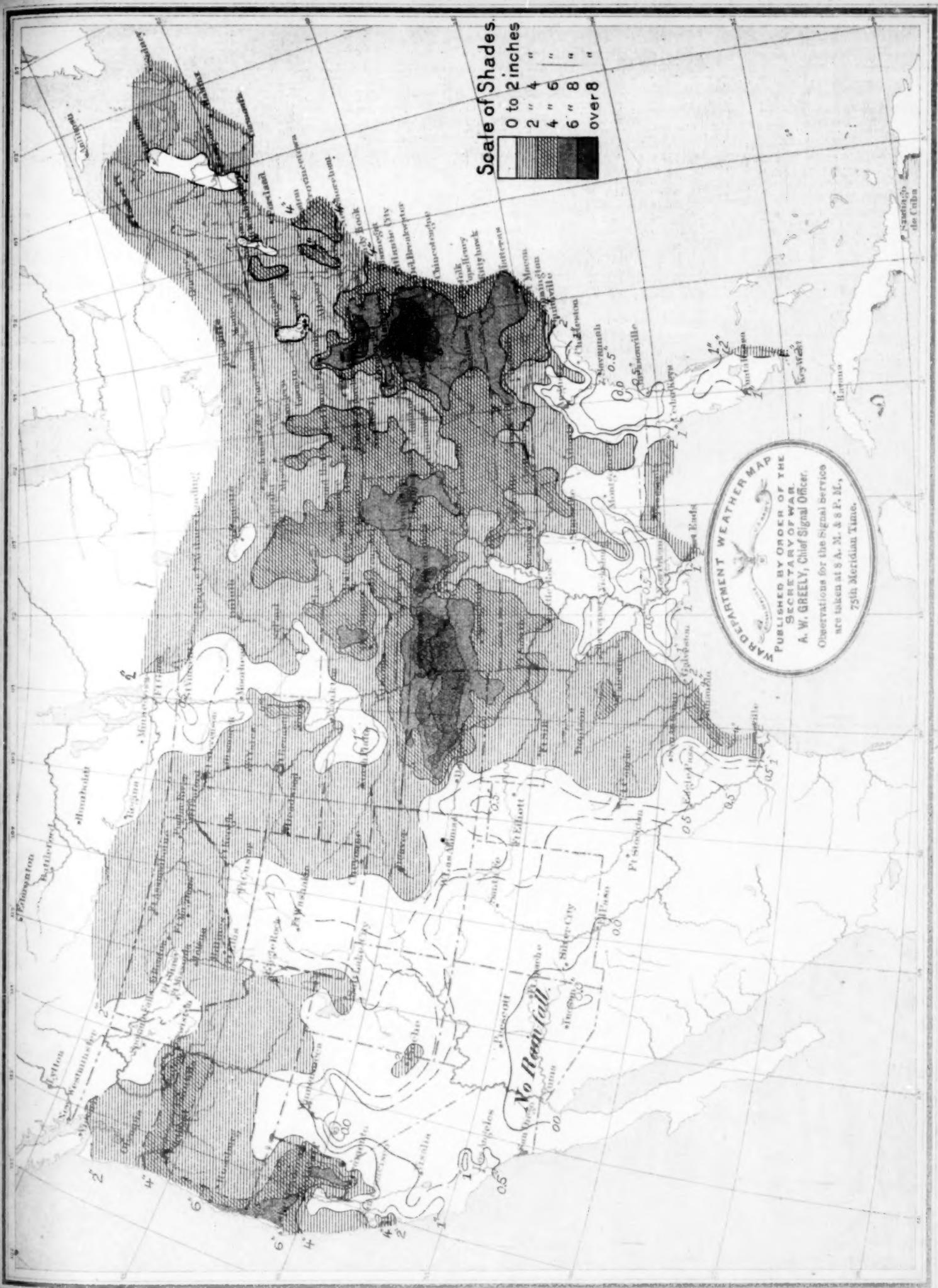
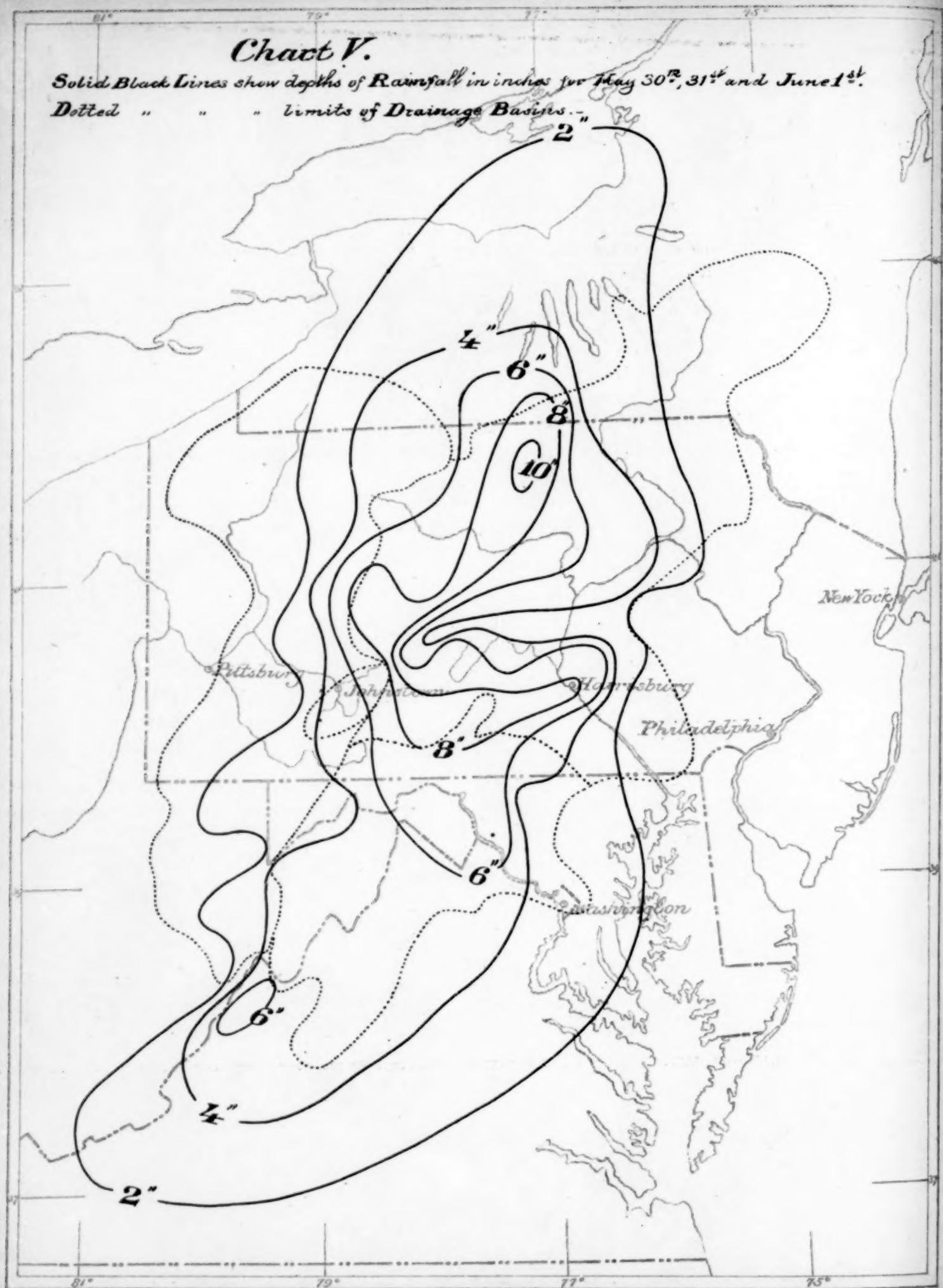


Chart V.

*Solid Black Lines show depths of Rainfall in inches for May 30th, 31st and June 1st.
Dotted " " " limits of Drainage Basins. -*



*List of voluntary stations of the Signal Service, with their respective observers, who furnish meteorological reports for the Monthly Weather Review.
Reports have not been received from those marked with an asterisk (*) in time to be used in the Review for May, 1889.*

Place of observation and observer.	Place of observation and observer.	Place of observation and observer.	Place of observation and observer.
ALABAMA. Ashland, M. N. Manning. Autumn, Alabama Weather Service. Bermuda, Wm. Fowler. Butler, B. F. Gilder. Canton, J. G. Michael. Columbiana, W. D. Lovett. Elkmont, D. J. Moore. Gadsden, D. P. Goodhue. Livingston, Prof. J. W. A. Wright. Notes, A. M. Weiler. Mount Willing, W. M. Garrett. New Market, Dr. Goss, D. Norris. Troy, Jas. Waldaner. Valley Head, E. P. Nicholson, M. D. Wiggins, M. D. Jones.	DISTRICT OF COLUMBIA. Kendall Green, Deaf and Dumb Institute. FLORIDA. Altamonte Springs, M. E. Bingham. Alva, Chas. E. Robins. Archer, A. F. Wyman. Fort Meade, A. H. Adams. Homeland, J. S. Wade. Kissimmee, E. E. W. Brewster. Lake City, Dr. J. C. Neal. Manatee, Mrs. Mary W. Broberg. Matanzas, Mrs. B. E. Dupont. Merritt's Island, Rev. J. H. White. Tallahassee, Rev. Dr. W. H. Carter. Villa City, J. Emory Round.	KANSAS—Continued. Atkin, E. Atkin. Bendena, G. Campbell. Cawker City, A. G. Alrich. Colby, C. E. Bennett. Cunningham, E. Shaw. Elk Falls, Dr. A. C. Williams. Emporia, Prof. T. H. Dinsmore, Jr. Englewood, C. D. Perry. Globe, C. M. Bell. Globe, Wm. Featherston. Havensville, L. W. Dennen. Independence, J. M. Altaffer. La Harpe, Isaac S. Coe. Lawrence, Prof. F. H. Snow. Lebo, C. B. Jennings. Leoti, A. P. Barker. Manhattan, C. P. Blachley. Manhattan, F. J. Rogers. Morse, B. P. Edgington. Rome, D. M. Adams. Salina, J. H. Gibson. Santa Fé, Judge A. P. Heminger. Sedan, J. W. Goodell. Topeka, Kansas Weather Service. Tribune, S. B. Jackson. Wakefield, Wm. P. Cochran. Wellington, John H. Wolfe. Yates Center, F. R. Gray.	MICHIGAN—Continued. Hudson, Major A. H. Boies. Kalamazoo, W. A. Black. Lansing, Dr. H. B. Baker. Lansing, Michigan Weather Service. Marshall, G. H. Greener, M. D. Mottville, J. A. Hartster. Thornville, John S. Cautkins. Traverse City, S. E. Wait. Ypsilanti, J. C. Bemiss. Ypsilanti, C. S. Woodard.
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ARKANSAS. Land Hill, Silas C. Turnbough. Little Rock, Arkansas Weather Service.	ILLINOIS. Anderson, Dr. A. Fouch. Barstow, Geo. R. Gooding. Berkeley, Prof. F. Soulé. Cayuga, T. Salisbury. Centreville, Wm. Barry. Colgate, Seward Cole. Crescent City, D. S. Shotwell. Evergreen, S. Holland. Georgetown, C. M. Fitzgerald. Gran Valley, B. F. Berriman. Hansford, Dr. W. H. Miller; A. E. Gribi. Hydesville, E. T. Foss. Joiner, T. T. Tidball. La Grange, Jos. Dominics. Lewis Creek, John Tuohy. Los Banos, A. Widmann. Nicolaus, Alvah Pendleton. Oakland, Dr. J. B. Trembley. Orville, Hiram Arents. Riverside, W. E. Keith. Sacramento, B. H. Gerrish. Salinas, Dr. E. K. Abbott. San Bernardino, A. K. Holt. San Luis Obispo, J. E. Zunis. Santa Barbara, H. D. Vail. Santa Clara, A. Block. Santa Maria, L. E. Biochman. Stockton, W. W. Trifett. Sunerville, T. B. Sanders. Vacaville, G. O. Colburn. Walla Walla Creek, J. Titcomb. Walnut Creek, A. L. Bancroft. Wheatland, Wm. Lumbard. Willow, David Bentley.	KENTUCKY. Ashland, J. M. Ferguson. Bernstadt, John de Planta. Bowling Green, M. H. Crump. Falmouth, F. G. Held. Frankfort, E. C. Went. Franklin, T. W. MacGill. Louisville, Kentucky Weather Service. McHenry, M. G. Duncan. Madisonville, T. J. Gill. Millersburg, Rev. C. Pope. Mount Sterling, H. C. McKee. Owensborough, Watkins & Carter. Owenton, J. S. Cox.	MISSOURI. Conception, Rev. Fr. Paul. Excelsior Springs, A. Reinisch. Fayette, Prof. T. Berry Smith. Frankford, W. W. Vermillion. Grand Pass, E. R. Graham. Lakeman, C. Ayres. New Frankfort, G. W. Hawkins. Osark, J. J. Brown. Pierce City, J. J. Spilman. Princeton, Wm. Hirona. Saint Louis, Missouri Weather Service. Warren, Prof. J. H. Frick.
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ARKANSAS. Benton, I. S. Putnam. Colorado Springs, Colorado Weather Service.	ILLINOIS. Anderson, Dr. A. Fouch. Barstow, Geo. R. Gooding. Berkeley, Prof. F. Soulé. Cayuga, T. Salisbury. Centreville, Wm. Barry. Colgate, Seward Cole. Crescent City, D. S. Shotwell. Evergreen, S. Holland. Georgetown, C. M. Fitzgerald. Gran Valley, B. F. Berriman. Hansford, Dr. W. H. Miller; A. E. Gribi. Hydesville, E. T. Foss. Joiner, T. T. Tidball. La Grange, Jos. Dominics. Lewis Creek, John Tuohy. Los Banos, A. Widmann. Nicolaus, Alvah Pendleton. Oakland, Dr. J. B. Trembley. Orville, Hiram Arents. Riverside, W. E. Keith. Sacramento, B. H. Gerrish. Salinas, Dr. E. K. Abbott. San Bernardino, A. K. Holt. San Luis Obispo, J. E. Zunis. Santa Barbara, H. D. Vail. Santa Clara, A. Block. Santa Maria, L. E. Biochman. Stockton, W. W. Trifett. Sunerville, T. B. Sanders. Vacaville, G. O. Colburn. Walla Walla Creek, J. Titcomb. Walnut Creek, A. L. Bancroft. Wheatland, Wm. Lumbard. Willow, David Bentley.	KENTUCKY. Ashland, J. M. Ferguson. Bernstadt, John de Planta. Bowling Green, M. H. Crump. Falmouth, F. G. Held. Frankfort, E. C. Went. Franklin, T. W. MacGill. Louisville, Kentucky Weather Service. McHenry, M. G. Duncan. Madisonville, T. J. Gill. Millersburg, Rev. C. Pope. Mount Sterling, H. C. McKee. Owensborough, Watkins & Carter. Owenton, J. S. Cox.	MISSOURI—Continued. Perrin, Prof. A. Kennedy. Shelbyville, H. W. Prissler. South Fork, A. B. Gilbert.
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NEW YORK. Alfred Centre, F. S. Place. Angelica, J. P. Slocum. Ardenia, Richard A. Arden. Auburn, Geo. Casey. Barnes' Corners, W. C. Fawdry. Boyd's Corners, Thomas Manning. Canton, Henry Priest. Constableville, R. Sanford Miller. Cooperstown, G. Pomeroy Keese. Eden, W. P. Huat. Elmira, Gerity Brothers.	MASSACHUSETTS. Amherst, Miss S. Snell. Amherst, Massachusetts Agricultural Experimental Station. Blue Hill, Rev. A. K. Teele. Blue Hill Observatory, A. L. Rotch. Cambridge, Harvard College Observatory. Chestnut Hill, Desmond Fitzgerald. Deerfield, Rev. A. Hazen. Dudley, Conant Observatory. Fall River, C. V. S. Remington. Heath, B. B. Cutler. Holyoke, J. W. Dornan. Leicester, Arthur Kendrick. New Bedford, Thomas R. Rodman. Newburyport, F. V. Pike. North Billerica, C. H. Kohlrausch. Provincetown, John R. Smith. Royalston, Miss Lizzie W. Chase. Somerset, Eliasha Slade. Taunton, E. U. Jones, M. D. Westborough, G. S. Newcomb. Williamstown, Williams College Observatory. Worcester, J. B. Hall.	NEW YORK. Alfred Centre, F. S. Place. Angelica, J. P. Slocum. Ardenia, Richard A. Arden. Auburn, Geo. Casey. Barnes' Corners, W. C. Fawdry. Boyd's Corners, Thomas Manning. Canton, Henry Priest. Constableville, R. Sanford Miller. Cooperstown, G. Pomeroy Keese. Eden, W. P. Huat. Elmira, Gerity Brothers.	NEW YORK. Alfred Centre, F. S. Place. Angelica, J. P. Slocum. Ardenia, Richard A. Arden. Auburn, Geo. Casey. Barnes' Corners, W. C. Fawdry. Boyd's Corners, Thomas Manning. Canton, Henry Priest. Constableville, R. Sanford Miller. Cooperstown, G. Pomeroy Keese. Eden, W. P. Huat. Elmira, Gerity Brothers.

List of voluntary stations of the Signal Service, with their respective observers, who furnish meteorological reports for Monthly Weather Review—Continued.

Place of observation and observer.	Place of observation and observer.	Place of observation and observer.	Place of observation and observer.
NEW YORK—Continued. Factoryville, T. P. Yates. Fleming, Robt. Warwick. Friendship, Jesse D. Rogers. Genoa, Mrs. N. S. Yates. Hess Road Station, C. H. Spaulding. •Hudson, M. P. Williams. Humphrey, Chas. E. Whitney. Iliion, G. A. Trowbridge. Ithaca, Cornell University. Ithaca, New York Weather Service. Kingston, H. A. Stone. Le Roy, Prof. F. M. Comstock. Lowville, W. Hudson Stephens. Lyons, Dr. M. A. Veeder. Middleburgh, F. X. Straub. Newfane Station, F. B. Clark. New York City, Central Park Observatory. Nineveh, W. J. Barnett. North Hammond, C. A. Wooster. •North Volney, J. M. Patrick. Number Four, Chas. Fenton. Palermo, E. B. Bartlett. Palmyra, L. D. Cummings. Pendleton, W. D. Lovell. •Penn Yan, Geo. R. Young. Perry City (near), W. H. Jeffers. Potsdam, Peter Vilas; G. W. F. Smith. Queenbury, De Witt C. Jenkins. Salem, W. W. Hance. Saranac Lake, Jas. P. Mills. Savona, M. S. Collier, M. D. Setauket, Selah B. Strong. Somerset, J. W. Thurber. South Canisteo, J. E. Wilson. 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Owsley. Kent, P. W. Eigner. Kenton, L. J. Demarest. Lordstown, W. S. Dean. Napoleon, Dr. T. C. Hunter. North Lewisburg, H. D. Gowey. Orangeville, E. N. Hyde.	OHIO—Continued. Portsmouth, Dr. D. B. Cotton. Poland, Chas. Stewart. Salineville, J. W. Manning. Shaneville, John Roth. Shiloh, Peter Bowman. Tiffin, Rev. T. H. Sonedecker. Vienna, W. D. McCorkle. Wauseon, Thos. Mikesell. Westerville, Prof. John Haywood. West Milton, Luke S. Motte. •Winfield, W. H. Stahl. Yellow Springs, Miss Eliza G. Rice. OREGON. Albany, John Briggs. Bandon, Geo. Bennett. East Portland, Dr. Geo. Wigg. Eola, Thos. Pearce. Grant's Pass, Jno. G. Jessup. La Grande, J. K. Romig. •McMinnville, Prof. W. J. Crawford. Mount Angel, Rev. F. Barnabas Held. Tillamook, A. P. Wilson. PENNSYLVANIA. Altoona, Chas. B. Dudley, M. D. Aquia, D. M. Sheely. •Blooming Grove, John Grathwohl. Blue Knob, A. H. Boyle. •Catawissa, Robt. M. Graham. Corry, Wm. Loveland. Drifton, H. D. Miller. Dyberry, Theo. Day. •East Brook, L. E. Stunkard. Easton, Dr. J. W. Moore. Edinborough, C. F. Sweet. Franklin, Joseph Bell. Germantown, Thos. Meehan. Glencairn, Nathan Moore. Haverford, H. V. Gummere. Le Roy, Geo. W. T. Warburton. Meadville, David Logan. Meshoppen, Stephen S. Jenkins. Nisbet, J. S. Gibson. Petersburg, J. E. Rooney. Philadelphia, Pennsylvania Weather Service. Philippsburg, G. F. Dunkle. Pleasant Mount, J. D. Brennan. Quakertown, J. L. Heacock. Reading, C. M. Dechant. Salem Corners, T. B. Orchard, M. D. State College, Agricultural Experimental Station. Tipton, Miss C. J. Wilson. Troy, Rev. M. Gustin. Tuscarora, R. J. Micky. Wellsville, Hiran D. Deming. West Chester, Dr. Jesse C. Green. •Westtown, Wm. F. Wickersham. RHODE ISLAND. Kingston, C. O. Flagg. SOUTH CAROLINA. Aiken, Dr. W. H. Geddings. Cedar Springs, J. T. Bayley. Columbia, South Carolina Weather Service. Kirkwood, Colin Macrae. Statesburgh, Dr. W. W. Anderson. TEXAS. Austin, Oscar Samuels. Austin, Q. C. Smith, M. D.	TEXAS—Continued. Baird, D. Richardson. Bear Creek Ranch, W. H. Potter. Belton, E. A. Sterling. Brazoria, H. Stevens. Brenham, J. G. Sloan. Brownwood, J. F. Mayo. Cedar Hill, J. P. Berry. Cleburne, P. J. Norwood. College Station, Prof. J. H. Kinney. Colorado, Fred R. Blount. Columbia, J. S. Rogers. Corsicana, E. L. Gibson. Corsicana, W. H. Hamilton. Decatur, H. D. Donald. Forestburgh, J. N. Morris. Fort Worth, Whit Dryden. Fredericksburgh, Arthur Striegler. Gainesville, D. F. Ragsdale. Gallinas, Lum Woodruff. Galveston, Texas Weather Service. Graham, A. B. Grant. Granbury, E. H. Snider. Houston, A. Hutchinson. Howe, W. M. Smith. •Huntsville, G. Buckingham. Ingersol, E. T. Page. La Grange, Jos. Cottam. Lampasas, Dr. C. M. Ramsdell. Longview, G. W. Kreh. Luling, W. H. Rather. Merkel, J. L. Vaughan. Mequite, Silas G. Lackey. New Braunfels, Paul Wipprecht. New Ulm, C. Bunge. Pecos City, H. H. Merriman. Silver Falls, C. M. Tilford. Snyder, A. C. Wilmeth. •Victoria, W. S. Schmidt. Waco, W. H. Godber. UTAH. Levan, A. B. Larsen. VERMONT. Brattleborough, W. H. Childs. Burlington, W. B. Gates. Coventry, W. H. Tibbets. East Berkshire, H. B. Lovering. Lunenburg, Dr. Hiram A. Cutting. Manchester, Rev. E. P. Wild. Newport, M. B. Trasher. Saint Johnsbury, F. Fairbanks. Stratford, H. F. J. Scribner. VIRGINIA. Alum Springs, F. H. Campbell. Bolar, G. F. Eakle. Bird's Nest, C. R. Moore. Christiansburg, H. D. Walters. Dale Enterprise, L. J. Heatwole. Marion, A. T. Lincoln. Petersburgh, Jas. M. Colson, Jr. Smithfield, J. R. Purdie. Spottsylvania, B. W. Jones. Summit, J. R. Sim. University of Virginia, James Wearmouth. •Variety Mills, J. H. Micklem. Wytheville, Howard Shriver. WASHINGTON TERRITORY. Blakely, R. M. Hoskinson. Vashon, Mrs. C. B. Carpenter. WEST VIRGINIA. •Clarksburg, R. T. Lowndes. •Hartmonsburg, V. C. Tabb. Parkersburgh, T. G. Field. •Brockport, R. D. J. Echols. Tyler Creek, F. M. Swann. WISCONSIN. Cadiz, B. C. Curtis. Delavan, George L. Collier.	WISCONSIN—Continued. Embarrass, J. E. Breed. Fond du Lac, J. C. Wedge. Fredonia, B. H. Meyer. Friendship, J. M. Harrison. Glasgow, Henry M. Crombie. Grantburg, M. L. Roby, M. D. Greenwood, H. J. Thomas. Hayward, J. M. Custard. Lincoln, A. J. Loose. Madison, Washburn Observatory. Manitowoc, Miss Clasina Lips. Neillsville, W. Heaslett. Oshkosh, Prof. W. N. Mumper. Richland Centre, H. M. Ludwig. Summit Lake, E. S. Koepnick. Viroqua, F. J. Bold. Waupaca, G. H. Yapp. Weston, R. R. Wilkinson. FOREIGN. •Burnside, S. A., Dr. C. J. Hering. Grand Turk, West Indies, Geo. I. Gibbs. Guanajuato, Mexico, Meteorological Observatory. Hamilton, Bermuda, Gen. Russell Hastings. Killisnoo, Alaska, Jos. Zuboff. La Logia, Mexico, H. Patrick. Leon, Mexico, Prof. M. Leal. Mazatlan, Mexico, Leon P. Acosta. Mexico, Mexico, Meteorological Observatory. Monterey, Mexico, Dr. Wm. De Ryee. Montreal, Quebec, C. H. McLeod. New Westminster, B. C., Capt. A. Pease. Port au Prince, Hayti, Prof. J. Scherer. Pueblo, Mexico, Catholic Institute. Topolobampo, Mexico, Mrs. Lillian Whitehill. Zacatecas, Mexico, Jose A. y Borilla. New stations in May, 1889. Signal, Ariz., Wm. Koshland. Strawberry, Ariz., L. P. Nash. Volunteer Springs, Ariz., W. J. Hill. Walnut Grove, Ariz., T. B. Carter. Iowa Hill, Cal., C. F. Macy. Amour, Dak., Jno. J. Angus. Alexandria, Dak., L. C. Taylor. Napoleon, Dak., Julius H. Hoof. Roscoe, Dak., C. H. Spencer. Point Peter, Ga., C. M. Witcher. Lemhi Indian Agency, Idaho, T. F. Maloney. Guthrie, Ind., Morris Collar. Eagle Grove, Iowa, C. A. Schaffter. Pointe à la Hache, La., F. C. Myers. Cumberland, Md., Howard Shriver. Albion, Mich., Chas. E. Barr. Fort Logan, Mont., Wm. Gaddis. Glendale, Mont., J. H. Ray. Powder River, Mont., J. M. Graham. Auburn, Nebr., G. D. Carrington. Kimball, Nebr., D. Henderson, Jr. Stuart, Nebr., C. E. Barber. Clayton, N. Mex., H. E. Byler. Arcade, N. Y., H. W. Clough. Rome, N. Y., Dr. Sutton. Beallsville, Ohio, R. G. McCaughy. Menardville, Tex., Louis Runge. Beaver, Utah, Rev. J. D. Gillian. Nephi, Utah, W. R. May. Ella, W. Va., Henry Resseger. Egion, W. Va., Julius Schert. Gladesville, W. Va., S. L. Zinn. Kingwood, W. Va., J. E. Murdoch. Pleasant Hill, W. Va., D. Fitchell. Seven Pines, W. Va., J. R. Shaver. Rivesville, W. Va., J. T. Parsons and P. F. Prickett. Tannery, W. Va., G. H. Tremby.

Military posts from which meteorological reports were received, through the Surgeon General of the Army, in time to be used in the preparation of the Monthly Weather Review for May, 1889.

ALABAMA.	COLORADO.	IDAHO.	MARYLAND.	NEBRASKA—Cont'd.	NEW YORK—Cont'd.	TEXAS—Cont'd.
Mount Vernon Barracks.	Crawford, Fort.	Boisé Barracks.	McHenry, Fort.	Robinson, Fort.	West Point Mil. Acad'my.	Ringgold, Fort.
ARIZONA.	Lewis, Fort.	Sherman, Fort.	MASSACHUSETTS.	Sidney, Fort.	Willett's Point.	San Antonio, Post-st.
Apache, Fort.	Logan, Fort.	ILLINOIS.	Springfield Armory.	NEVADA.	OHIO.	UTAH.
Bowie, Fort.	Lyons, Fort.	Rock Island Arsenal.	Warren, Fort.	McDermit, Fort.	Columbus Barracks.	Du Chene, Fort.
Huachuca, Fort.	Trumbull, Fort.	Sheridan, Fort.	MICHIGAN.	NEW MEXICO.	OREGON.	Douglas, Fort.
Lowell, Fort.	DAKOTA.	INDIAN TERRITORY.	Brady, Fort.	Bayard, Fort.	Klamath, Fort.	WEST VIRGINIA.
McDowell, Fort.	A. Lincoln, Fort.	Gibson, Fort.	Mackinac, Fort.	Marcy, Fort.	PENNSYLVANIA.	Monroe, Fort.
Mojave, Fort.	Bennett, Fort.	Reno, Fort.	Wayne, Fort.	Seiden, Fort.	Frankford Arsenal.	Myer, Fort.
San Carlos.	Buford, Fort.	Sill, Fort.	Snelling, Fort.	Stanton, Fort.	RHODE ISLAND.	Washington, Fort.
Verde, Fort.	Meade, Fort.	Supply, Fort.	MISSOURI.	Union, Fort.	Adams, Fort.	Spokane, Fort.
Whipple Barracks.	Pembina, Fort.	Hays, Fort.	Jefferson Barracks.	Wingate, Fort.	TEXAS.	Townsend, Fort.
ARKANSAS.	Randal, Fort.	Leavenworth, Fort.	MONTANA.	NEW YORK.	Bliss, Fort.	Vancouver, Fort.
Hot Springs.	Seisseton, Fort.	Leavenworth Prison.	Assiniboine, Fort.	Columbus, Fort.	Brown, Fort.	Walla Walla, Fort.
Little Rock Barracks.	Sully, Fort.	Riley, Fort.	Custer, Fort.	David's Island.	Clark, Fort.	WYOMING.
California.	Totten, Fort.	KENTUCKY.	Keogh, Fort.	Hamilton, Fort.	Concho, Fort.	Brider, Fort.
Alcatraz Island.	Yates, Fort.	Newport Barracks.	Magnin, Fort.	Madison Barracks.	Concho, Fort.	D. A. Russell, Fort.
Angel Island.	DISTRICT OF COLUMBIA.	LOUISIANA.	Missouri, Fort.	Niagara, Fort.	McKinney, Fort.	Laramie, Fort.
Benicia Barracks.	Washington Barracks.	Jackson Barracks.	Poplar River, Fort.	Plattsburgh Barracks.	Pilot Butte, Camp.	McKinney, Fort.
Bidwell, Fort.	FLORIDA.	MAINE.	Shaw, Fort.	Porter, Fort.	Sheridan, Camp.	Pilot Butte, Camp.
Gaston, Fort.	Kennebunk Arsenal.	Niobrara, Fort.	NEBRASKA.	Schuyler, Fort.	Washakie, Fort.	Washakie, Fort.
Mason, Fort.	Saint Francis Barracks.	Preble, Fort.	Omaha, Fort.	Wadsworth, Fort.	Peru Colorado, Camp.	
Presidio of San Francisco.				Watervliet Arsenal.		
San Diego Barracks.						